Fall 2017

Effects of a Collaborative Care for Depression Intervention on Health Service Utilization and Depression Severity

Girlyn Arganza Cachaper
Old Dominion University, girlynacachaper@gmail.com

EFFECTS OF A COLLABORATIVE CARE FOR DEPRESSION INTERVENTION ON HEALTH SERVICE UTILIZATION AND DEPRESSION SEVERITY

by

Girlyn Arganza Cachaper
B.A. May 1993, University of Virginia
M.A. December 2000, Georgia State University

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for the Degree of

DOCTOR OF PHILOSOPHY

HEALTH SERVICES RESEARCH

OLD DOMINION UNIVERSITY
December 2017

Approved by:

Harry Q. Zhang (Director)

Martha T. Early (Member)

Carolyn M. Rutledge (Member)

ABSTRACT

EFFECTS OF A COLLABORATIVE CARE FOR DEPRESSION INTERVENTION ON HEALTH SERVICE UTILIZATION AND DEPRESSION SEVERITY

Girlyn Arganza Cachaper
Old Dominion University, 2017
Director: Dr. Harry Q. Zhang

Depression is the leading cause of disability worldwide, disproportionately affecting the Medicaid population. Collaborative care programs for depression are transforming primary care to increase access and coordinate physical and behavioral health services. Understanding the relationships between components of collaborative care programs, characteristics of participants, and their effect on outcomes can maximize program effectiveness.

A pilot collaborative care for depression program within a Medicaid managed care organization was evaluated using administrative claims and case management data. Participants (*n*=444) included adults with prior Medicaid coverage and a comparison group identified using one-to-one propensity score-matching. Multivariate logistic regression models estimated the odds of decreases in depression severity and acute care, and increases in outpatient services. T-tests and chi-squares were used to identify factors influencing clinical improvement in depression.

After controlling for covariates, group status was not a significant predictor of the odds of increased health services use. Increased comorbidities was a significant predictor of increased outpatient physical health visits (OR=1.32, *95% CI* [0.57,1.06]). Among intervention participants (*n*=234), significant individual and social determinants of health leading to higher odds of decreased depression and changes in health services use were identified. Additionally, lower illness severity was associated with clinical improvement in depression, $t(45.47)=2.60$, $p<.05$, $d = 0.46$, 95% CI [.40, 3.18]. Increased follow up contacts were associated with lower

depression severity, OR=1.42, 95% CI [1.17, 1.71]. Comparing primarily face-to-face (FTF), primarily telephonic, and equal telephone/FTF contacts, telephonic participants were more likely to have lower depression severity and to decrease/maintain their inpatient stays compared to those with equal telephone/FTF, OR=0.28, 95% CI [1.34, 9.90]; OR=4.64, 95% CI [1.35, 15.94], respectively. Using an ecological framework for vulnerable populations, individual and social determinants associated with changes in health services use and depression outcomes were identified. Findings support adapting case management services to address complex needs, increasing follow up contacts, and utilizing telephonic along with FTF contacts. Lower contacts resulted in worse outcomes. Managed care organizations can play a bigger role with health service researchers in supplying data for evaluation of innovative programs. Additional research with collaborative care depression programs addressing Medicaid populations is needed.

This dissertation is dedicated to my parents who instilled in me their ethos of hard work and perseverance, the drive to better myself, and a respect for education. It took that foundation to start a doctorate. It is also dedicated to my husband, Bernie, and daughter, Karis, whose love, support, and belief in me helped me finish it.

ACKNOWLEDGMENTS

Many people who have contributed to the successful completion of this dissertation. I extend heartfelt thanks to my committee members, Dr. Harry Zhang, Dr. Martha Early, and Dr. Carolyn Rutledge, and to the director of the collaborative care for depression intervention, Dave Johnson. Although Dave was not an official committee member, his knowledge of the collaborative care program, the operational processes of the health insurance company, and his wealth of experience in mental health and medical homes was truly invaluable. All members provided countless hours of support, guidance, and patience in shepherding me through this process. Much appreciation also goes to the Behavioral Health department of the MCO providing the data for this study, particularly Heather Kaas. As a former employee of the company, I know working with me to pull the data was in addition to a fast-paced work schedule and this took time out of their days and evenings.

This dissertation truly took a village to complete. My parents, Epitacio and Erlinda Arganza, and my in-laws, Basilio and Bonnie Cachaper, were instrumental in assisting me throughout graduate school and the dissertation. I cannot thank them enough for the emotional, financial, and family support they provided through countless meals, hours of child care, and believing in me. My director, Dr. Kathie Zimbro, and co-workers at the Quality Research Institute of Sentara, deserve thanks for their biostatistical consultation and doctoral-level guidance.

Finally, my husband and daughter, Bernie and Karis Cachaper, must be thanked for putting up with my typing at 2 a.m., skipping a few children's birthday parties, and late dinners. My little family gets their wife and mom back.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (cont'd.)

Table Page

LIST OF TABLES (cont'd.)

Table Page

LIST OF FIGURES

CHAPTER I

INTRODUCTION

According to the World Health Organization (WHO) depressive disorders are the leading cause of disability worldwide as measured by total years lost due to disability (WHO, 2012). By 2030, it will become the leading cause of global burden of disease (World Federation for Mental Health [WFMH], 2012). Closer to home, results from the 2012 National Survey on Drug Use and Health estimate that 19% of adults aged 18 or older in the United States reported they had a mental illness, excluding substance use disorders, within the past year (Department of Health and Human Services [DHHS], 2013). An estimated 7% of all U.S. adults had at least one major depressive episode within the past year (Center for Behavioral Health Statistics and Quality, 2016). The total economic burden of depression in the United States is estimated at $210.5 billion per year (Greenberg et al., 2015). Much of the treatment for depression has occurred in primary care settings, along with patients' comorbid chronic medical conditions (Katon, 2012). This highlights the need for primary care to utilize enhanced models of care that are collaborative and coordinated with behavioral health specialists. This need is even more profound among people covered by Medicaid who face additional challenges due to very limited incomes and/or disabilities.

Mental Health in the United States

The most prevalent forms of mental illness in the U.S. are anxiety and mood disorders (Centers for Disease Control [CDC], 2013). According to the *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.; DSM-5; American Psychiatric Association, 2013) depression, including major depressive disorder, bipolar disorder, and dysthymia, refers to mental health disorders in which feelings of sadness, loss, anger, or frustration interfere with daily life for two

weeks or longer. If left untreated, mental illnesses can lead to poor self-care and treatment adherence resulting in negative health outcomes, increased mortality, and decreased work productivity (Unutzer, Harbin, Schoenbaum & Druss, 2013). The National Center for Health Statistics reports that 43% of people with severe depressive symptoms experience difficulties in their home, work, and social lives (Pratt & Brody, 2014). Furthermore, people with a serious mental illness (SMI) have premature mortality rates two to three times higher than those of the general population with an estimated 60% of early mortality due to physical illness (De Hert et al., 2011). SMI includes major depression, schizophrenia, bipolar disorder, obsessive compulsive disorder (OCD), panic disorder, post-traumatic stress disorder (PTSD) and borderline personality disorder (National Alliance on Mental Illness, n.d.). Of note, 'behavioral health services' refers to treatment of both mental illness and substance use disorders.

Comorbid Mental Health and Chronic Medical Conditions in the United States

Chronic medical conditions, namely heart disease, stroke, cancer, diabetes, obesity, and arthritis, account for 70% of deaths each year in the United States and 75% of health care costs (CDC, 2009). Having co-occurring chronic physical and mental health conditions are associated with elevated symptom burden, higher mortality, decreased quality of life, higher functional impairment, and higher costs (Goodell, Druss & Reisinger Walker, 2011). The high rates of comorbid mental disorders and chronic conditions are due to the bidirectional influence these disorders have on one another. Having a mental health disorder is a risk factor for developing a chronic physical/medical condition and vice versa (Goodell, Druss & Reisinger Walker, 2011). Individuals with schizophrenia and bipolar disorder are up to three times more likely to have three or more chronic conditions compared with people without mental health conditions (Carney, Jones & Woolson, 2006; Carney & Jones, 2006). The 2003 National Comorbidity

Survey Replication reports that 68% of adults with a mental disorder had at least one medical condition; conversely, 29% of adults with a physical disorder had a comorbid mental health disorder (Druss & Walker, 2011). The overall health care costs for people treated for depression averaged $426.5 billion between 2010-13 (Thorpe, Jain & Joski, 2017). This figure underestimates the true cost to the U.S. health care system of people with depression as it does not include those with an undiagnosed depressive disorder.

As the U.S. population continues to age, it is becoming a nation with multiple chronic conditions (Tinetti et al., 2012). National estimates on the prevalence of specific chronic mental health and medical comorbidities vary widely due to methodological differences in studies, including for the most commonly studied comorbidity, individuals with depression and diabetes (Katon, 2009). A meta-analysis of 39 studies involving patients with diabetes reported 31% experienced significant depressive symptoms, whereas a separate population-based epidemiologic study reported nearly 21% of the study participants had diabetes and major or minor depression (Anderson, Freedland, Clouse & Lustman, 2001; Katon, von Korff, Ciechanowski et al., 2004). Data from 1,004 patients enrolled in an integrated primary care intervention within 17 primary care clinics across the U.S. reported the following prevalence rates with comorbid anxiety disorders: hypertension/high blood pressure (37%), back problems (33%), migraine headaches (29%), vision problems (24%), arthritis or rheumatism (24%), and asthma (21%) (Campbell-Sills et al., 2013). One study suggests a probable causal relationship between obesity and subsequent depression. Roberts, Deleger, Strawbridge & Kaplan's (2003) prospective study on the temporal relation between obesity and depression and found that people with obesity at baseline were twice as likely to be depressed five years later; however, depression at baseline did not increase the risk for obesity.

The course and prognosis of common chronic conditions are negatively affected by depression due to one's decreased ability to self-manage medical condition(s) and decreased adherence to treatment plans (Katon et al., 2004). The ability to work is also affected by mental illness as seen in increased work absenteeism, short-term disability, and decreased productivity and presenteeism, which in turn affect one's economic stability and health outcomes (CDC, 2014). From an economic standpoint, the presence of comorbid depression or anxiety significantly increases medical and mental health expenditures, with over 80% of the increase occurring in medical expenditures (Melek & Norris, 2008).

Depression among Medicaid Beneficiaries

Medicaid is the joint Federal-State program that provides health care assistance to specific groups of low-income individuals and families and it is one of the biggest payers of health care in the United States (Centers for Medicare & Medicaid Services [CMS], 2013). Over the last 50 years it has also become the single largest payer of mental health services in the U.S. and is becoming a key payer of substance use disorder services (Andrews, Grogan, Brennan & Pollack, 2015). Federal actuarial reports estimate 72.2 million people, or one in five U.S. citizens, were enrolled in Medicaid for any period of time in 2012 (CMS, 2013). Beginning in January 2014, the Affordable Care Act (ACA) provided the States the authority to expand Medicaid eligibility to nearly all individuals younger than 65 years with incomes below 133% of the Federal Poverty Level, including low-income adults without children, without needing a waiver (CMS, 2013).

A high proportion of individuals enrolled in Medicaid have depression and schizophrenia compared to the privately insured (Thomas et al. 2005; Berg et al., 2014). At the national level, recently published data from a study of the Medical Expenditure Panel Survey (MEPS) pooled

from 2010-13 found that 16.8% of Medicaid patients were treated for depression and comorbid medical conditions (Thorpe, Jain & Joski, 2017). Depression estimates vary across states. A Medicaid HMO in Colorado estimated 20% of its adult Medicaid enrollees had a depressive disorder (Thomas et al., 2005). A New Hampshire study of its Medicaid members found that over 50% of its continuously enrolled adult Medicaid members (i.e., continuously enrolled 11 or more months) had some evidence of depression, with the highest prevalence rates found in those with permanent disability due to mental illness (NH Dept. of Health and Human Services [NHDHHS], 2007). Of note, the continuously enrolled are made up of a higher percentage of permanently disabled than the overall population (NHDHHS, 2007). Medicaid enrollees suffer more severe levels of depression and incur higher depression-related medical costs compared to other populations (Frank, Goldman & Hogan, 2003). The New Hampshire study also reveals that although Medicaid members with evidence of depressive symptoms received treatment for depression, primarily antidepressant therapy (88%), and were seen by a therapist (61%), they averaged 3.8 times higher payments than members without evidence, including 4.7 times higher hospitalization rates and 2.5 times more emergency room use (NHDHHS, 2007). Furthermore, a two-fold increase in payments was observed in members with evidence of depression when a comorbid condition is present (NHDHHS, 2007). Significant barriers to depression care exist because access for Medicaid-enrolled adults is limited compared to the privately insured (Melfi et al., 2000). Network inadequacy resulting from low participation rates of psychiatrists in Medicaid and insufficient numbers of substance abuse treatment professionals play a major role in their inequitable access to behavioral health services (Paradise, 2015).

Total spending on health care averaged $37.6 billion annually between 2010-13 for Medicaid enrollees who were treated for depression (Thorpe, Jain & Joski, 2017). The majority

of which is not spent on mental illness-related care. Spending was primarily related to inpatient care (28.4%), prescriptions (28.0%), and office visits for medical conditions (21.9) (Thorpe, Jain & Joski, 2017). A breakdown of costs by behavioral health-related versus medical care for physical comorbidities revealed that only 15% of total health care costs for people diagnosed with any behavioral health disorder goes to behavioral health-specific care (Thorpe, Jain & Joski, 2017). Proper care management of both physical and behavioral health conditions is needed to affect total health care costs.

Vulnerable, or at-risk, populations face numerous barriers to accessing adequate health care that often lead to delayed preventive health service use followed by increased use of acute services (Small, 2014). Results of the Oregon Health Insurance Experiment reveal that expanding Medicaid coverage to low-income, uninsured residents resulted in reduced rates of depression by nine percentage points; increased self-reported mental health status; and increased use of physician services, prescription drugs, and preventive care two years after the insurance lottery (Baicker et al., 2013). The Benjamin Franklin adage "an ounce of prevention is worth a pound of cure" is truer today as populations in the U.S. and around the world attempt to manage the increasing disease burden of non-communicable chronic diseases. Upstream approaches that promote the use of recommended prevention services and outpatient visits for people with chronic conditions are needed to prevent worse health outcomes downstream. The integration of mental health and medical care is an important step in redesigning the health system to address that need.

Role of Mental Health in Primary Care

Since Reiger, Goldberg and Taube's seminal article in 1978, primary care has been labeled the 'de facto mental health system' and is seen as integral in identifying and treating

mental health disorders. Key reasons for this include individuals' lack of access to specialty mental health care, particularly with the Medicaid population; lack of trained providers; and concerns over stigma associated with utilizing those services (WFMH, 2012). Over one-third of U.S. counties, particularly those with high percentages of Black of Hispanic residents, do not contain any outpatient mental health treatment facilities that accept Medicaid (Cummings et al., 2013). Forty-two percent of people with mental health conditions state they are ashamed or embarrassed of their condition (NMHA, 2000). As many as one-third to one-half of the patients seen in a primary care setting are identified with a mental health, substance abuse, or other behavioral health need (Robinson & Rieter, 2007). Depression is the most common mental health condition addressed within primary care settings (Katon & Schulberg, 1992). Nineteen percent of primary care patients qualify for a major depression diagnosis (Olfson et al., 2000). Furthermore, primary care physicians are responsible for prescribing an estimated 60 to 80 percent of psychotropic medications, yet compliance with recommended safety monitoring of these prescriptions needs improvement (Pril, Beck, Safren & Kim, 2001; Mark, Levit & Buck, 2009; Gallimore, Schreiter & Sokhal, 2016). As more primary care patients continue to seek mental health treatment through their PCPs rather than psychiatry, the need for specialty mental health to collaborate with general medicine is even greater (Olfson, 2016).

Studies report higher premature mortality rates and worse functional status earlier in people with multiple chronic conditions compared to people with fewer conditions (Benjamin, 2010). In a 2009 national sample of discharged adults, Steiner and Friedman (2013) found that patients with two or more chronic disorders compared to those with no or one chronic disease had a 50% increase in mortality rates. These negative outcomes are the result of unnecessary hospitalizations and tests, more adverse drug events, and higher reported conflicting medical

advice (Wolff, Starfield & Anderson, 2002). Coordination of care is more difficult but even more important for this heterogeneous population (Benjamin, 2010). Only half of the patients seen in primary care who need a mental health referral receive it, and most do not attend the first visit (AIMS, 2014; Kessler, 2012). The U.S. Preventive Services Task Force (USPSTF), an independent non-federal panel of experts that conducts evidence reviews of preventive health care services, recently recommended depression screening of all adults in the general population with implementation requiring that adequate support systems be in place (USPSTF, 2016). Support systems are necessary to ensure accurate diagnosis, effective treatment, and appropriate follow-up (USPSTF, 2016). At the system-level, the USPSTF recommends the evidence-based primary care collaborative care for depression management approach (USPSTF, 2016). Follow-up care would necessitate the coordination of services across mental health and other specialists with primary care providers, particularly for patients with mental health and chronic medical comorbidities. However, existing fee-for-service reimbursement strategies and fragmented or uncoordinated health care delivery make it difficult for physicians and other caregivers to work together across providers and service settings (IOM, 2010). Funk and Ivbijaro (2008) list a number of reasons for integrating mental health into primary care:

- Burden of mental disorders is significant
- Mental health and physical health problems are interwoven
- Treatment gap for mental disorders is enormous
- Primary care setting for mental health increase access
- Delivery of mental health services in primary care settings reduces stigma & discrimination
- Cost-effective to treat in primary care settings
- Most people treated in collaborative primary care have good outcomes

Collaborative care for behavioral health programs. Within the last twenty years, a number of different models that integrate mental health services in primary care have been

implemented within the U.S. Known as collaborative care models, they incorporate mental health services into a multidisciplinary team within a primary care setting (Unutzer, Harbin, Schoenbaum & Druss, 2013; Runyan, 2013). Some of the more well-documented programs include Minnesota's DIAMOND project, RESPECT-Depression, and IMPACT (Gilbody, Bower, Fletcher, Richards, & Sutton, 2006; Unutzer et al., 2002; Nutting et al., 2008). There is wide evidence to support this innovative approach to health service delivery, even if there is not ample research yet to support one model of collaborative care as the gold standard (Runyan, 2013).

This enhanced primary care approach entails three main components: 1) inclusion of a depression care manager (non-physician) and a consulting psychiatrist to participating primary care clinics, 2) implementation of clinical processes that would systematically track clinical mental health symptoms, and 3) utilization of stepped care that adjusts treatment based on patient progress (Unutzer et al., 2013). In general, a behavioral health case manager screens and tracks mental health conditions within a primary care setting. This evidence-based approach is an effective model for treating people with depression (Gilbody, Bower, Fletcher, Richards & Sutton , 2006). The role of behavioral health managers in this program differs from traditional psychotherapists within mental health settings. Within the primary care setting, they serve as behavioral health experts providing short-term counseling employing problem-solving therapy and motivational interviewing techniques. They are part of a larger multidisciplinary health team that manages the patient population's mental health and substance abuse needs as well as the psychosocial aspects related to the management of their chronic conditions (Runyan, 2013).

Systematic reviews of collaborative care for depression approaches have consistently found that these programs result in improved treatment adherence, reduced depressive

symptoms, higher patient satisfaction, and cost effectiveness compared to usual treatment (Thota et al., 2012; Jacob et al., 2012; Gilbody et al., 2006; Gilbody, Bower & Whitty, 2006; Unutzer, Harbin, Schoenbaum & Druss, 2013). Collaborative care interventions have been found to reduce depressive symptomatology within six months of enrollment (Gilbody et al., 2006). In their systematic literature review, Jeeva, Dickens and Coventry (2013) also identified several studies supporting the hypothesis that treatment of depression with diabetes can lead to a reduction in clinical physical symptoms as well as depression severity. Collaborative care programs are estimated to save $15 billion in savings per year to the Medicaid program by addressing the need for depression care among people with comorbid medical and mental health conditions (Unutzer, Harbin, Schoenbaum, & Druss, 2013).

One well-documented collaborative care program in the literature is the Improving Mood-Promoting Access to Collaborative Treatment (IMPACT) model developed by a group from the University of Washington (Unutzer et al., 2002). The IMPACT program follows the general components of collaborative care models, requiring the addition of a behavioral health coach and a consulting psychiatrist to participating primary care clinics to engage in systematic screening, diagnosis, and to collaborate with members and physicians on treatment of depression. Treatment and interventions are structured to be consistent with the individual's preferences, utilizing techniques such as motivational interviewing, establishing health goals, health coaching, and education. These studies primarily focused on older adults with depression in primary care settings. Evaluations consistently support findings of decreased depression symptoms, improved functional status, and better quality of life among the intervention participants at 18 and 24 months after their enrollment (Hunkeler et al., 2006).

Support for an integrated health system for behavioral health management has taken root through federal initiatives and policy mechanisms. This movement initiated from pediatrics and was promoted by the National Center for Quality Assurance (NCQA)'s patient-centered medical home model. SAMHSA's patient-centered medical home (PCMH) and the Primary Care and Behavioral Health Care Integration (PBHCI) program in 2009, as well as the Medicaid Health Home State Plan Option of the Affordable Care Act (ACA) section 2703 are key federal drivers.

STATEMENT OF THE PROBLEM

The changing healthcare needs of the U.S. adult population increasingly involve multiple chronic conditions, often with a depressive disorder as a comorbid disorder. To adequately meet the population's overall healthcare needs requires transformation of the current health delivery system. People with mental health and chronic medical conditions have worse clinical, quality of life, and cost outcomes compared to those without the additional mental health burden (Goodell, Druss & Reisinger Walker, 2011). Collaborative care for depression interventions have been implemented in primary care settings to better address existing mental health needs. Strong evidence exists that promotes the effectiveness of these programs. A review of 79 RCT studies report improved treatment adherence, reduced depressive symptoms, higher patient satisfaction, improved quality of life (Archer et al., 2012). However, the evaluations of these programs and the specific strategies leading to the success of these programs have not been assessed using a multi-level theoretical framework nor have they focused on health services utilization rates. Furthermore, few studies have focused on Medicaid populations. Given the increased human resources, the costs associated with these programs, and the synergistic relationship in the management of mental and physical health needs, the need exists for a better understanding of the relationship between components of these programs, characteristics of the

participants, and the effect on participants' health services utilization patterns. This need is particularly true for populations at greater risk for poor health outcomes, such as low-income and disabled groups covered through Medicaid, in which the effectiveness of depression treatments is not well-documented in the literature.

PURPOSE OF THE STUDY

There are three primary aims in this study. First, the study will evaluate the effectiveness of a pilot collaborative care for depression program in reducing acute care, namely inpatient admissions and ED visits, and increasing outpatient services among Medicaid patients with diagnosed depression compared to patients with similar characteristics receiving usual care. Second, using a health services utilization theoretical framework, the study will identify individual and community-level determinants of change in acute care and outpatient care service use and depression severity among the program participants. Third, characteristics of the program's follow-up sessions between the behavioral health coaches and program participants as they relate to health service utilization and depression severity will be examined. Within each aim, inpatient, ED, and outpatient healthcare services are further reduced into physical and behavioral health services where claim counts are sufficient.

SIGNIFICANCE OF THE STUDY

Foremost in any healthcare study are the needs of the patients. This study is significant in that it focuses on the healthcare needs of a Medicaid-eligible population, which defines them as a 'vulnerable' population due to disability, severely limited financial resources, or specific challenges that make them eligible for coverage. Vulnerable populations are at greater risk of suffering poor health and generally have greater health needs (Shi & Stevens, 2010). From a national policy viewpoint, vulnerable populations consume a greater share of the nation's health care resources and the number of those in need is growing (Shi & Stevens, 2010).

The collaborative care approach is a key strategy within primary care in achieving the "triple aim" goals of improving the health of the population; reducing health care costs without harm to individuals, families, and communities; and, improving the patient's health care experience. The IOM reports that it takes 17 years for a health care innovation to be incorporated into practice (IOM, 2001). This study is timely in that regard. In recent years, the federal government has shown support for a more integrated health system through federal programs and policy mechanisms, for example, the SAMHSA Primary and Behavioral Health Care Integration (PBHCI) program and the Medicaid Health Home State Plan Option in the Affordable Care Act section 2703. This study extends the health service field's evidence base on the effectiveness of programs that promote an integrated, coordinated, patient-centered approach. Given the additional human and financial resources required, and the additional commitment on the patient's end, research that can shed light on the associated factors that lead to improved outcomes with this adopted approach is vital. The ability to apply an evidence-based framework to integrated care approaches helps healthcare professionals better pinpoint in which settings and with what populations this model will be most effective. The most recent variation on the Andersen Behavioral Model of Utilization (1968), the Gelberg-Andersen Behavioral Model for Vulnerable Populations (BMVP, Gelberg, Andersen & Leake, 2000), is an appropriate option. Its application to collaborative care programs will allow a more comprehensive understanding of the multi-level factors that influence utilization of health services among a population considered at-risk for negative health outcomes.

Another significant contribution of this study is that it focuses on utilization patterns in addition to changes in depression severity with participants. Most evaluations of collaborative care programs have focused on depression remissions as the primary outcomes, and rightfully so,

however as an integrated care approach, the overall health of participants is expected to improve over time, requiring less reliance on acute health care services.

Finally, this study also sheds light on the outcomes of the first two years of a multi-year intervention. Findings from this study will provide additional insight into the degree of change in service utilization and depression scores that can be expected during the ramp up years of a collaborative care program, particularly within participants' first six months, which may not be as significant when compared to their results a year later or longer with the program. In some cases, total net medical and pharmacy costs for participants within the first year increased due to increased use of outpatient services and medications, with expected overall savings occurring further down the road (Waxmonsky et al., 2012).

Ultimately the goal in implementing a collaborative care program is to provide holistic patient-centered care that improves quality of life; ensures timely and appropriate health care services to prevent debilitating and costly acute care; and achieves cost efficiencies, in short, ensuring the "triple aim" approach of improved population health, improved care experiences, and lower costs (Berwick, Nolan & Whittington, 2008).

CHAPTER II

BACKGROUND OF THE STUDY

This chapter summarizes the literature relevant to the research objectives of this study. It is organized into five main sections: (1) the study population (2) evidence-base for collaborative care for depression programs in primary care, (3) description of the Behavioral Model of Vulnerable Populations, (4) dependent and independent variables, and (5) limitations of existing research literature.

LITERATURE REVIEW

Collaborative Care for Depression Programs in Primary Care

The acceptance within the medical community to integrate behavioral health services in primary care has strengthened within the last fifteen years. The literature is replete with hundreds of initiatives in the U.S. that fall under the collaborative care rubric. Collaborative care models are meant to move team care from parallel relationships to interdisciplinary approaches. Communication and delivery processes include the common goal of person-centered care (Sanchez & Ordono, 2013). Behavioral health providers that are integrated into primary care often adapt to a faster pace, more diverse patient needs, and different demands from the primary care team compared to the traditional behavioral health specialty approach (McFeature & Pierce, 2012).

This form of enhanced primary care is achieved by adding a depression care manager and a consulting psychiatrist to participating primary care clinics; clinical processes that systematically track clinical depression outcomes, and using an early intervention and prevention focus in which a population based screening is implemented to identify patients with depressive symptoms. A care plan is developed that may include counseling, brief intervention by the

behavioral health professional, or a prescription or referral to a mental health specialists or some combination. Follow-up with completion of the standardized scale with scoring that includes decision supports regarding treatment informs changing treatment approaches if there is not an improvement in depressive symptoms. This changing treatment based on patient response is identified as "stepped care". Generally, stepped care involves a hierarchy of treatment options delivered in such a way that treatments start at the lowest level of services appropriate for the individual and are adjusted, or stepped up, to more resource-intense services based on patient progress (Unutzer, Harbin, Schoenbaum & Druss, 2013; Runyan, 2013). Researchers from the Milbank Memorial Fund (2010) distilled information on programs implemented in the U.S. to identify eight practice models. Within in the literature on collaborative care for depression programs they may be labeled coordinated, co-located, or integrated care depending on the level of integration between mental health specialty services and primary care (Milbank Memorial Fund, 2010).

There is wide evidence to support this innovative approach to health service delivery, even if there is not ample research yet to support one model of collaborative care as the gold standard (Runyan, 2013). The approach has been an effective model for treating people with depression (Gilbody, Bower, Fletcher, Richards & Sutton, 2006). In general, a care manager screens and tracks mental health conditions within a primary care setting, such as a Medicaid health home. These care managers have a different role from traditional psychotherapists within mental health settings. As part of the multidisciplinary team led by the primary care physician, they are responsible for addressing patients' mental health disorders. Their roles include educating patients, supporting treatment decisions and medication adherence, monitoring outcomes, brief counseling, coordinating psychiatrist or other mental health specialist needs, and

addressing the psychosocial aspects of managing their chronic medical conditions (Sanchez & Adomo, 2013; Runyan, 2013). Care managers provide a valuable service by easing the burden of difficult patients and building trust with the primary care providers. They are essential to the success of the collaborative care models (Sanchez & Ordono, 2013). Three well-known program models from the collaborative care for depression literature are summarized below.

Project IMPACT

One well-documented collaborative care program is the Improving Mood-Promoting Access to Collaborative Treatment (IMPACT) model developed by a group from the University of Washington (Unutzer et al., 2002). The IMPACT program follows the general components of collaborative care models, requiring the addition of a behavioral health coach and a consulting psychiatrist to participating primary care clinics to engage in systematic screening, diagnosis, and to collaborate with members and physicians on treatment of depression. Treatment and interventions are structured to be consistent with the individual's preferences, utilizing techniques such as motivational interviewing, establishing health goals, health coaching, problem-solving therapy, and education. These studies primarily focused on older adults with depression in managed care primary care settings and have consistently supported findings of decreased depression remission, improved functional status, and better quality of life among the intervention participants at 18 and 24 months after their enrollment (Hunkeler et al., 2006). This is the program model from which the intervention used in this current study was based.

Colorado Access: Depression Care Management Program

This program differs from other depression care management (DCM) programs in that it is administered at the health plan level versus provider primary care sites. Colorado Access is a nonprofit public sector health plan which developed and implemented a depression care

management program delivered by care managers (Waxmonsky et al., 2012). Depression screenings were given to high medical risk and high cost Medicaid plan members, resulting in 370 participants in the program. Evaluations of the DCM program report significantly reduced depression severity up to 12 months after intervention when compared to baseline depression scores. Additionally, at 12 months, 56% of the participants had either a 50% reduction in severity or a score below the clinical range for major depression as determined by the PHQ-9. Longitudinal economic analyses comparing the 12 months prior to enrollment and 12 months after revealed a significant but modest increase in ER visits, outpatient office visits, and overall medical and pharmacy costs after adjusting for length of time enrolled. The researchers explained that most of those cost increases resulted from higher outpatient service utilization and net pharmacy costs as opposed to increased ED admission or acute hospitalizations (Waxmonsky et al., 2012).

Support for an integrated health system has taken root through federal initiatives and policy mechanisms, including the patient-centered medical home (PCMH) and the Primary Care and Behavioral Health Care Integration (PBHCI) program in 2009, and the Medicaid Health Home State Plan Option of the Affordable Care Act (ACA) section 2703. This state-level benefit that started in 2011, enables organizations to better coordinate services for Medicaid members with one or more chronic conditions, especially where serious and persistent mental health conditions occur (CMS, 2010). This policy provision allows states to link Medicaid beneficiaries with a serious mental illness or a chronic condition to a health home to receive coordinated primary care and behavioral health services and details payment mechanisms to finance these integrated services (Unutzer, Harbin, Schoenbaum & Druss, 2013). With the efforts of a designated care coordinator, services are managed under a ‘whole-person’ approach

to health service delivery, including primary care, behavioral health, acute, and long term support services (CMS, 2010).

DIAMOND (Depression Improvement Across Minnesota Offering a New Direction)

In 2008 this collaborative care initiative was launched in 10 primary care medical clinics throughout Minnesota by the Institute for Clinical Systems Improvement (ICSI) (ICSI, 2008). It is an evidence-based model that built on the successes of project IMPACT out of the University of Washington and included the same components of using a validated screening tool, systematic tracking and monitoring, a stepped care approach, depression case management and psychiatric consultation. What is unique to this initiative is its payment structure redesign. ICSI developed a payment model that reimburses the participating medical groups through bundled services for depression care management and consulting psychiatric services that lead to improved depression outcomes. Similar to project IMPACT, the PHQ-9 is used to assess ongoing depression management (ICSI, 2008). Periodic depression care management payments are made to the medical groups by the health plans for each enrolled patient. The bundled set of services are billed through a single billing code used only by certified DIAMOND sites to maintain the program's sustainability (ICSI, 2008).

Systematic reviews of collaborative care for depression approaches, including these three programs, have consistently found that these interventions result in improved treatment adherence, reduced depressive symptoms, higher patient satisfaction, and improved cost effectiveness compared to usual treatment (Thota et al., 2012; Jacob et al., 2012; Gilbody et al., 2006; Gilbody, Bower & Whitty, 2006; Unutzer, Harbin, Schoenbaum & Druss, 2013; Archer et al., 2012). Collaborative care programs such as the DIAMOND project in Minnesota have found that a 40% decrease in PHQ-9 depression severity scores for moderately severe depression

during the first month of treatment is not an unrealistic goal of stepped care programs (Angstman, Rohrer & Rasmussen, 2012).

Treating Depression among Medicaid Beneficiaries

Effective methods to identify and treat depression within the most appropriate settings is especially important with at-risk populations, yet there is insufficient data on the extent to which Medicaid-enrolled adults receive depression care that adheres to clinical practice guidelines. Current clinical guidelines for patients with severe or chronic mild to moderate major depressive disorder (MDD) include strong recommendations for the following:

- a combination of antidepressants and referral to behavioral health for evidence-based psychotherapy;
- monitoring patients for suicidal ideation;
- behavioral health education for patients with mild to moderate MDD;
- continued monitoring of outcomes of care over time using the PHQ-9;
- long-term treatment, monitoring, and follow up require follow-up at specific time intervals, including assessment for adherence, side effects, suicidal ideation, and response to treatment (Kaiser Permanente Care Management Institute, 2012).

Depression treatment among the Medicaid population is inadequate (Teh et al., 2010). Teh and colleagues (2010) conducted a study of 1,098 Medicaid-enrolled adults who initiated new depression treatment and found that younger adults, African-Americans, and those whose depression treatment began with an inpatient stay were less likely than their comparison groups to receive the minimum number of psychotherapy visits within clinical guidelines for depression. Overall, 30% of the individuals studied received inadequate depression treatment (either psychotherapy or psychopharmacology). New Hampshire data profiling Medicaid members' health care experience during calendar-year 2005 reveal differences by eligibility group in obtaining mental health specialty appointments (NHDHHS, 2007). Sixty-one percent of all members with any evidence of depression had at least one mental health encounter during the

year, ranging from 41% for elderly covered members to 83% for those with a mental health disability. Although percentages vary, reports of inadequate mental health care appear consistent over time and place. In Colorado during calendar-year 2000, one Medicaid health plan reported that only 32.8 percent of patients (n=852) with a psychiatric disorder saw a mental health professional during the one-year study period and of those with depression only 36.2 percent attended more than one specialty mental health visit (Thomas et al, 2005).

The Medicaid Health Home State Plan Option is a recent state-level benefit, started in 2011 under the ACA, that enables organizations to better coordinate services for Medicaid members with one or more chronic conditions, especially where serious and persistent mental health conditions occur (CMS, 2010). This policy provision allows states to link Medicaid beneficiaries with a serious mental illness or a chronic condition to a health home to receive coordinated primary care and behavioral health services and details payment mechanisms to finance these integrated services (Unutzer, Harbin, Schoenbaum & Druss, 2013). With the efforts of a designated care coordinator, services are managed under a 'whole-person' approach to health service delivery, including primary care, behavioral health, acute, and long term support services (CMS, 2010).

THEORETICAL FRAMEWORK

The theoretical frame work used in this study is the Behavioral Model of Vulnerable Populations (BMVP) developed by Gelberg, Andersen & Leake (2000). This model is a variation of the well-known Behavioral Model of Health Service Use (BMHSU, Andersen, 1995). The basic tenets of the BMVP are the same as the original BMHSU that was originally developed in the late 1960s to help in understanding conditions, currently referred to as social determinants of health, that either enabled or hindered access to and utilization of health services

with a focus towards policy development that would reduce disparities to access care (Andersen, 1995).

The model posits three components that represent a causal ordering of factors predicting health service utilization (Andersen, 1995). These components include *predisposing, enabling,* and *need factors*. Later versions also include the influence of health system factors in determining health behavior and ultimately health status of the population under study (Andersen & Newman, 2005; Andersen, 1995). *Predisposing factors* are characteristics of the individual or their social environment that existed prior to their perception of illness. There are three subcomponents of *predisposing factors* that include social structure, health beliefs, and demographic factors (Andersen & Newman, 2005). These are typically immutable factors, such as age, gender, education level, occupation, prior health service utilization that are associated with health service use but may not be directly responsible for health service use (Andersen & Newman, 2005). *Enabling factors* are personal, family, or community resources that enable or impede health service use. Traditional examples include living arrangement, usual source of care, and insurance status. *Need factors* are represented by perceived illness and objective evaluations, such as by a provider, of the individual's health status. The need factors are often the more proximal predictors of health service use (Andersen & Newman, 1973; Andersen, 1995).

The original model developed in the 1960s has gone through four distinct phases. At each phase the model grew to encompass more distal predictors and outcomes. The next phase was a major revision to the model developed by Aday and colleagues at the Center for Health Administration Studies, University of Chicago (Andersen, 1995). They added the influence of the health care system, both national health policy and the health system's resources as

determinants of the health service use, as well as the more distal outcome of health service utilization, namely consumer satisfaction (Andersen, 1995). The third phase added both perceived and evaluated health status as other health status outcomes in conjunction with consumer satisfaction as outcomes of health behaviors. The more immediate health outcome became 'health behaviors' and encompasses health services utilization and personal health practices such as diet, exercise, and self-care due to their influence on health outcomes (Andersen, 1995). The fourth phase developed in the 1990s focused on the dynamic and iterative nature of the model, depicting health outcomes as having a feedback effect on subsequent predisposing, enabling resources, and perceived need for services, which in turn influence health behaviors (Andersen, 1995).

Behavioral Model of Vulnerable Populations (BMVP)

The most recent expanded model of health service utilization, the Behavioral Model of Vulnerable Populations (BMVP, Gelberg, Andersen & Leake, 2000) purports that traditional risk factors such as age, gender, education level, and race/ethnicity are often associated with lower access to medical services primarily due to lack of access to resources and more pressing competing needs (Erlyana, Fisher & Reynolds, 2014). The addition of 'vulnerable' characteristics is expected to lead to inappropriate use of health services (Stein, Andersen & Gelberg, 2007). Populations are considered 'vulnerable' if they have community and associated individual characteristics that are risk factors for negative physical, psychological, and social outcomes (Aday, 2001). Figure 1 provides a detailed depiction of the model. Of note, these BMVP population characteristics are also referred to as social determinants of health within this document.

The factors associated with vulnerable populations often have additive effects and are important in addressing the use of non-discretionary (acute services) as compared with

discretionary (preventive, outpatient services) utilization. In their literature review of HIV vulnerable groups, Erlyana, Fisher & Reynolds (2014) discuss research that found that vulnerable factors, including unstable housing, abuse, risky sexual practices, and drug/alcohol use, were associated with lower outpatient medical services, lack of adherence to treatment, and higher use of emergency room services and hospitalizations. In accordance with the original Behavior Model for Health Andersen model, the BMVP aids in the understanding of health service utilization patterns specific to vulnerable groups for the purposes of addressing policy, financial, and access concerns affecting the overall health care system (Aday, 2001).

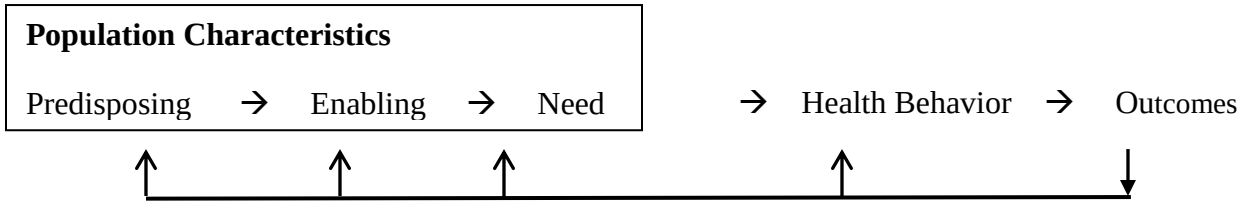
Much of the research using the BMVP has focused on homeless populations. One of the larger and earliest studies using this model analyzed data from 875 homeless women in Los Angeles county, California to predict desirable preventive care and outpatient office visits, and less desirable inpatient stays (Stein, Andersen & Gelberg, 2007). Using a path analysis, the structural model found several direct and indirect relationships with these outcome variables. Within this population, they found that drug use had a significant positive relationship with hospitalizations; African-American women were less likely to have had preventive care compared to white women; increased barriers to health care and psychological distress predicted less outpatient health service utilization (HSU); having a regular source of care predicted more outpatient and preventive HSU; and illness was associated with outpatient HSU and hospital admissions (Stein, Andersen & Gelberg, 2007). Later research found a nearly linear relationship between increase in vulnerabilities and the use of emergency room and inpatient services (non-discretionary), but no significant effect on obtaining a physical exam, considered a discretionary service (Small, 2010). In determining if there are significant impacts on emergency room use when comparing traditional predisposing, enabling, and need factors with vulnerable ones, Small

(2010) found support for both types of factors. The traditional characteristics of marriage, employment, insurance coverage, regular source of health care, and perceived health were positively associated with emergency room visits ($p \leq .05$); and vulnerable characteristics of history of mental health problems, a positive HIV/AIDS status, and a history of victimization, were more likely to be associated with at least one emergency room visit within the past 12 months. See Figure 1.

MODEL VARIABLES IN THE STUDY

Figure 2 shows how the BMVP framework is applied to the study, listing the population characteristics and their relationship to the health behavior and health status outcomes to be measured. The variables in italicized font are only available for the intervention group and will be used for additional analyses specific to these patients.

Figure 1. Behavioral Model of Vulnerable Populations



Traditional Domains

Age
Gender
Marital Status
Health Beliefs
-Value concerning health and illness
-Attitude toward health services
-Knowledge about disease
Social Structure
-Ethnicity
-Education
-Employment
-Social networks
-Family size

Vulnerable Domains

Social Structure
-Country of birth
-Acculturation/ Immigration/ Literacy
Sexual Orientation
Childhood Characteristics
-Homelessness
-Living conditions
-Subst. abuse
-Criminal behavior
-Mental Illness
-Psych. resource
-Victimization

Traditional Domains

Personal/ Family Resources
-*Insurance*
-Incomes
-Social support
-Perceived barriers to care
Community Resources
-Residence
-Region
-Health services resources

Vulnerable Domains

Personal/ Family Resources
-Competing needs
-Hunger
-Public benefits
-Self-help skills
-Ability to negotiate system
-Case manager/ Conservator
-Transport.
-Telephone

Community Resources
-Crime rates
-Social services resources

Traditional Domains

Perceived Health
-General population health conditions

Evaluated Health
-General population health conditions

Vulnerable Domains

Perceived Health
-Vulnerable population health conditions

Evaluated Health
-Vulnerable population health conditions

Traditional Domains

Personal Health Practices
-Diet
-Exercise
-Self-care
-Tobacco use
-Adherence to care

Use of Health Services
-Ambulatory care
-Inpatient care
-Alternative healthcare
-Long-term care

Vulnerable Domains

Personal Health Practices
-Food sources
-Hygiene
-Unsafe sexual behaviors

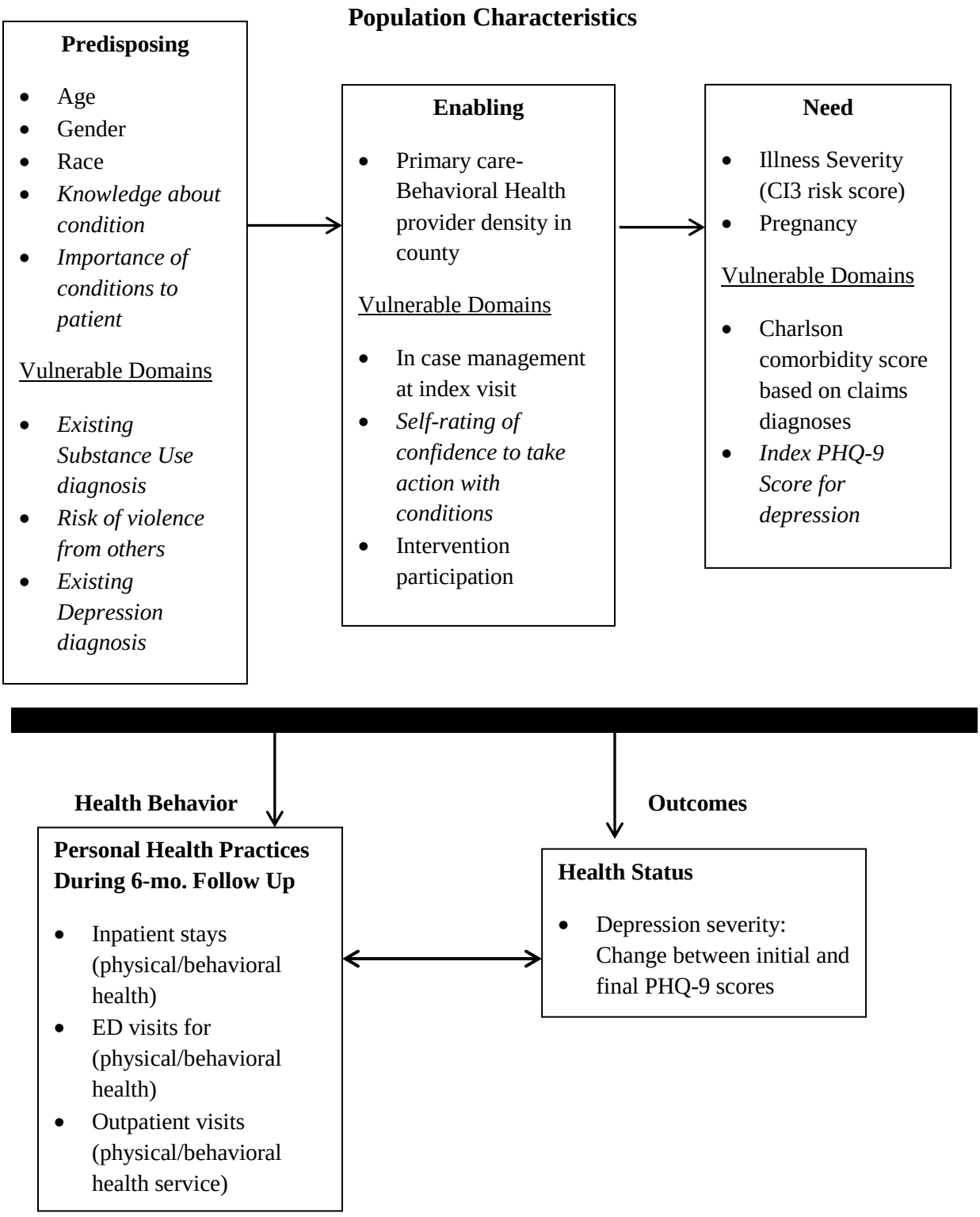
Traditional/ Vulnerable Domains

Health Status
-Perceived health
-Evaluated health

Satisfaction with Care
-General satisfaction
-Technical quality
-Interpersonal aspects
-Coordination
-Communication
-Financial aspects
-Time spent with clinicians
-Access/ Availability/ Convenience
-Continuity
-Comprehensive
-Administrative hassle

Source: Gelberg, L., Andersen, R. & Leake, B. (2000). The behavioral model for vulnerable populations: Application to medical care use and outcomes for homeless people. *Health Services Research, 34(6),* 1273-1302.

Figure 2. Application of the Behavioral Model for Vulnerable Populations to Study



Dependent Variables

Health behavior. Medicaid HMO and behavioral health claims and encounter data from the Colorado Access Medicaid health plan during calendar year 2000 revealed significantly higher total health care costs among adults with a psychiatric diagnosis (Thomas et al., 2005). Patients with an identified psychiatric disorder had health care costs higher by a factor of 2.24 compared to those without psychiatric disorders. These costs included medical and pharmaceutical costs. Furthermore, costs attributed to medical care were highest for patients with substance use disorder, anxiety, or depression compared to those with bipolar or psychotic disorders (1.79 – 2.34 times versus 1.09-1.10 times greater, Thomas et al., 2005). Emergency department visits and inpatient utilization are chosen as primary outcomes because they are often the focus of Medicaid case management efforts due to the higher costs associated with these healthcare settings (Leininger et al., 2014). Along with the use of outpatient services, these variables are typically studied as contributors to total health expenditures in economic analyses of collaborative care for depression programs (Gilbody et al., 2006; Jacob et al., 2012).

Frequent inappropriate use of acute care (emergency departments and hospitalizations) are a heavy financial burden on the overall health care system (Small, 2010). Limited access due to low primary care provider participation in Medicaid is a well-documented contributor to ED use (Government Accountability Office, 2011). Between 1997 and 2007 the annual number of visits to EDs increased 23%, with Medicaid adult enrollees accounting for most of the increase (Tang et al., 2010; Niska, Bhuiya & Xu, 2010; and Ghandi, Grant & Sabik, 2014). According to the 2013 National Hospital Ambulatory Medical Care Survey, Medicaid and Children's Health Insurance Program (CHIP) beneficiaries are the second highest group of ED patients, accounting for 30 percent of all visits, after the privately insured patients (Rui, Kang & Albert, 2013). With Medicaid expansion in the Patient Protection and Affordable Care Act, ED

visits are expected to continue to increase among low-income adults. Results from the Oregon Health Insurance Experiment in which the state used a lottery system to randomly assign individuals to Medicaid support this expectation. Increases in ED visits were found for conditions that could have been treated in primary care settings (Taubman, Allen, Wright, Baicker, & Finkelstein, 2014). Ghandi, Grant & Sabik (2014) analyzed a nationally representative sample of hospital-based ED visits between 2000 and 2009 and found that the largest number of non-emergent visits per person occurred among Medicaid enrollees compared to uninsured and privately insured individuals, with number of visits per 1,000 individuals ranging from 364.3 (95% CI = 301.1 – 427.6) in 2000 to 387.7 (95% CI = 309.2- 466.2) in 2009. Another national study by the Center for Health System Change (HSC), however, found that only 10 percent of nonelderly Medicaid patient ED visits were attributed to non-urgent symptoms and that the majority of these visits were for more serious medical issues (Sommers, Boukus & Carrier, 2012). Although this study found that Medicaid patients were not using the ED inappropriately, it may also signify unmet healthcare needs are occur due to lack of access to a regular source of care (RSC). Medicaid patients are more likely to report an ED or clinic as their RSC compared to privately insured patients who often list a physician's office (Shi & Stevens, 2010).

The Healthcare Cost and Utilization Project's (HCUP) review of national inpatient data from community hospitals found that hospital stays billed to Medicaid were more frequent and longer compared to the uninsured or privately insured. In 2012, there were 36.5 million hospital stays of which 20.9% were billed to Medicaid. Sixteen percent of all aggregate hospital costs were for stays covered by Medicaid, or $61.7 billion (Lopez-Gonzalez, Pickens, Washington & Weiss, 2014). Compared to uninsured and privately insured stays, the mean length of Medicaid

stays is longer (4.0 days, 3.8 days, and 4.3 days, respectively) (Lopez-Gonzalez, Pickens, Washington & Weiss, 2014).

Emergency department visits. Individuals with mental health and substance abuse conditions are a key subgroup of ED high utilizers (4 or more visits per year), constituting 12.5% of all visits across payors (CMS, 2014). Kumar, Clark, Boudreaux and Camargo (2004) conducted a multi-site Boston-area study of patients aged 18 years and older in the ED and found that 30% of them reported health problems that included depression within the past 12 months. Their study also revealed a socioeconomic, demographic and health status profile associated with depression among the ED patients. Associated factors include lower level of education; smoking; and self-reported anxiety, chronic fatigue, and back problems. Other studies have found that individuals diagnosed with major depression and chronic conditions had greater odds of having at least one emergency room visit compared to adults without chronic medical disorders (Egede, 2007).

Inpatient admissions. The most common diagnosis for inpatient care within the Medicaid population is mood disorders, representing 6.1% of their stays (Lopez-Gonzalez, Pickens, Washington & Weiss, 2014). Additionally, other behavioral health disorders (i.e., schizophrenia) ranked among the top 10 most frequent diagnoses for Medicaid stays. Of the top 10 diagnoses for Medicaid hospitalizations, six are identified as ambulatory care sensitive conditions (ACSCs) which are considered preventable with the proper outpatient and preventive care (Lopez-Gonzalez, Pickens, Washington & Weiss, 2014).

In an economic analysis of a collaborative care depression management program in five primary care clinics of an HMO, pre and post claims cost estimates were taken for the intervention group and a comparison group. The intervention group was 54% less likely to use

emergency department and 49% less likely to use inpatient psychiatric care (Reis-Brennan et al., 2009).

Outpatient visits. Outpatient services or ambulatory care cover a host of treatment, diagnosis, consultation, and rehabilitation services, including wellness and preventive services visits. Typically many preventive care services (i.e., pap smears, mammograms, prostate testing, blood pressure checks, cholesterol screening, etc.) are conducted in outpatient settings, such as doctor's offices. Strengthening outpatient care for individuals with mental health disorders has the potential to detect undiagnosed illnesses as well as prevent diagnosed disorders from progressing to more acute symptoms.

Adults with chronic physical conditions and depression are often at greater risk for poor self-care and use of preventive health services. Ellis, Grubaugh & Egede (2012) examined the association between major depression, preventive health behaviors, and quality of life indices among 5,869 adults with stroke from the 2006 Behavioral Risk Factor Surveillance Survey. Among the women in the study, those with major depression were less likely to receive a mammogram in the past two years or a pap smear in the past three years compared to the women without major depression. Mitchell et al. (2014) conducted a systematic review and meta-analysis of all major electronic databases through February 2014. They compared mammography screening rates among women with and without a mental illness. The pooled meta-analysis found significantly reduced rates of mammography screening in women with mental illness, including depression and mood disorders, and particularly among women with serious mental illness (OR=0.54, 95% CI 0.45-0.65).

In their economic review of the literature from 1980 to 2009 on collaborative care for depression programs Jacob et al. (2012) found evidence from seven studies that indicated a likely

increase in behavioral health outpatient costs along with a smaller increase in use of non-behavioral health outpatient care compared to usual care. Overall, savings on inpatient costs appears to outweigh increases in outpatient costs, however, the limited number of studies leaves this finding inconclusive.

Health Outcome: Depression Severity

Angstman and colleagues (2012) found that the severity of one's depression at intake is associated with 6-month remission. Multivariate analysis of patients with severe depression demonstrated a decreased likelihood for 6-month remission compared with those with moderate depression. Furthermore, for those patients who did not experience 6-month depression remission, their increase in PHQ-9 depression severity scores were significantly higher than their scores at baseline when controlling for all other variables.

Independent Variables

Population characteristics predicting utilization and depression. The following section highlights specific studies relating individual and social determinants of health used as predictors in this study with health service utilization, either medical or mental health, and depression severity. To narrow down the review, studies were chosen based on populations with depression and the application of collaborative care interventions, or use of the BMVP model as a theoretical framework for their study to be most relevant to the study at hand. In congruence with the BMVP, population characteristic variables are classified as traditional or vulnerable. Traditional variables relate to the general population, whereas vulnerable predictors are specific to the population under study and the unique challenges of their at-risk status. Across studies, which predisposing, enabling resources, and need variables that have a significant relation with study outcomes can vary, based on target population, intervention/treatment, identified predictors and outcomes, and statistical techniques, to name a few reasons.

Predisposing characteristics. Within the literature, individual characteristics that fall under the traditional *predisposing* component of the Andersen Behavioral Model, including female gender, younger age, lower levels of education, and racial/ethnic minority status are often treated as covariates due to their frequent association with a lower access to medical services (Erlyana, Fisher & Reynolds, 2014). Yet data from a study of 354 individuals with a lifetime diagnosis of major depression did not find gender and personality-related factors (i.e., extraversion, openness, neuroticism) to be significant predictors of help-seeking behaviors (Schomerus et al., 2013). In this population-based cohort study in Germany, older age, higher education, more perceived social support, presence of childhood abuse, higher levels of conscientiousness, lower levels of resilience, and higher depression severity were associated with help-seeking behaviors.

Age. In recent studies on age and health service utilization, Jaglal et al. (2014) found that after adjusting for covariates, younger participants (less than 67 years of age) of a telehealth chronic disease self-management program (CDSMP) participants showed a significant increase in outpatient physician visits whereas older participants (over 66 years) revealed a non-significant trend towards lower emergency department visits 12 months after their participation in the tele-CDSMP. Their findings were consistent with other evaluations of CDSMP.

Hendrie and colleagues found that older adults with serious mental illness experienced a 30% higher rate of medical emergency department (ED) visits ($p < .05$) and longer average lengths of stay per medical hospitalizations by three days ($p<.05$) compared to elderly patients without a serious mental illness in the same urban health care system.

Gender. Gender differences were found in the onset of mental health service utilization among people with physical illness (i.e., COPD, asthma, hypertension, and type II diabetes)

compared to a control cohort. Matheson et al. (2014) found that women with physical illness were most likely to use mental health services, followed by women in the control cohort, men with physical illness, and men in the control group. However, they did not find an interaction effect between gender and physical illness in mental health service utilization.

Race/ethnicity. Disparities exist in access, utilization, and outcomes of depression treatment among racial and ethnic minorities compared to non-Latino white Medicaid enrollees, resulting in a higher disease burden (Alegria et al., 2008). Data from a nationally representative sample found that racial/ethnic minorities were significantly less likely to access mental health treatment compared to non-Latino whites (Alegria et al., 2008). Minorities with depression who utilized services in the prior year were also more likely to receive depression treatment of a lower quality compared to non-Latino whites with depression, after adjusting for social and class-related variables including insurance coverage, poverty, and education (OR=0.24, 95% CI = 0.14-0.43) (Alegria et al., 2008).

Bridges, Andrews, Villalobos, Pastrana, Cavell & Gomez (2014) studied factors associated with the implementation of an integrated behavioral health care program among Latino and non-Latino primary care patients. Their study found that compared to non-Latino whites, Latino patients had significantly lower self-reported psychiatric distress, significantly higher clinician-assigned global assessment of functioning scores, and fewer received a psychiatric diagnosis at their initial visit. However, in terms of outcomes there was not a significant difference between the groups in utilization rates, improvement in symptoms, and level of satisfaction with integrated behavioral services.

Four studies funded by the National Institute of Mental Health (NIMH) Consortium on Psychiatric Epidemiology Studies examined mental health disparities among racial and ethnic

minorities (black, Hispanic, Asian, and other ethnic groups compared to whites (McGuire & Miranda, 2008). McGuire and Miranda's (2008) review of these studies slightly differed from other findings in the literature on racial disparities and mental health. They found that all subgroups of monitories reported lower or similar prevalence rates of lifetime and past year mental disorders compared to whites (McGuire & Miranda, 2008). However, delineations by type of mental health disorders, severity of symptoms, and access to mental health care are where disadvantages exists among minority groups. African Americans reported higher rates of schizophrenia, higher depression severity, and lower likelihood to received diagnosis-based mental health or substance abuse care compared to whites. Hispanic Americans reported advantages in mental health outcomes compared to whites, at the younger and older age ranges, but had worse outcomes in the years in between. Asian Americans, with the exception of Native Hawaiians, reported overall advantages in mental health outcomes compared to whites (McGuire & Miranda, 2008).

Psychosocial factors. Factors that influence self-efficacy in managing a chronic condition, particularly mood disorders, can mediate the effects of the behavioral health intervention. Confidence in taking action with one's conditions fall within this component of predictive factors. Gitlin and colleagues (2014) studied mediators of depression interventions (i.e., depression severity, depression knowledge and symptom recognition, behavioral activation, and anxiety) and their effect on functional disability among older African Americans ($\geq$ 55 years of age) with depressive symptoms living in an urban environment. The follow up time from was four months. Their study found that two mediators, 1) reduction in depression severity and 2) improved depression knowledge and symptom recognition, significantly mediated the depression

intervention's effect on functional disability, jointly explaining 62.5% of the intervention's effect.

Substance use disorder. The literature on dual diagnosis (mental health and substance abuse) finds that more than 40% of individuals with substance abuse issues also experience mental illness such as bipolar, depression, or anxiety disorders at some point during their lifetime (Mericle, Ta Park, Holck & Arria, 2012). Given the high likelihood for co-occurrence, substance abuse disorders is another predictor to take into account when studying a population with mental illness. The importance of this characteristic within vulnerable populations was highlighted in the Stein, Andersen & Gelberg (2007) study of 875 homeless U.S. women. In the bivariate correlations utilized in identifying significant BMVP predictors of preventive care, outpatient visits, and hospitalizations, drug use and alcohol problems were significant. Specifically, drug use problems, more common among homeless women, led to more hospitalizations (Stein, Andersen & Gelberg, 2007). In another study, Huang et al. (2013) studied receipt of substance abuse or mental health services in older adults with substance use disorders. The population studied was comprised of Medicare beneficiaries participating in a care management program for chronically ill members through Humana, Inc. After adjusting for covariates, comorbid depression and severe and persistent mental illness were each associated with either substance abuse or mental health service use, despite the overall low usage of these services within this group (Huang et al., 2013).

Risk of violence from others. The relationship between physical or sexual abuse and health service utilization bears out in the literature. Applying the BMVP, Erlyana et al. (2014) studied 1,993 HIV vulnerable adults and predictors of utilization of medical services in Office AIDS Programs and Policies funded agencies in Los Angeles, CA. They found that victims of

physical or sexual abuse were more likely to use these medical services. The researchers attributed poorer health status and higher health needs within this group as factors leading to higher service use. Chartier, Walker and Naimark (2007) found that those who experienced abuse at any time period (remote, ongoing, or recent abuse) were also more likely to utilize emergency care than those who never experience abuse.

Enabling resources. Enabling factors are those characteristics that are pertinent to the individual, family, or community that enable or impede the use of health services or adoption of positive health behaviors (Andersen, 1995).

Provider density. Andersen and Newman (2005) propose that certain community characteristics can influence health service use. If resources are plentiful, they may be used more frequently as opposed to if patients had long waits for appointments (Andersen & Newman, 2005). The number of health facilities and personnel available within a community directly affect access to care. Within the U.S., physician density, both specialists and family/general practitioners, is positively related to quality of care, as measured by each state's ranking of their health system performance (Cooper, 2008). Physician density is a strong predictor at the global level of health outcomes when analyzed with other healthcare human resource variables (Anand & Baernighausen, 2004).

Guerror and Kao (2013) analyzed 2010 data from the National Survey of Substance Abuse Treatment Services using geographic information systems to identify locations of facilities offering integrated mental health and substance abuse services in Los Angeles County, CA. Their research suggests that low-income and ethnic communities have less proximity and therefore limited access to facilities offering this type of integrated care, particularly areas with high Latino concentrations.

Case management/care coordination services. Joo (2014) analyzed data on Medicare beneficiaries with chronic illnesses who utilized community-based case management services. After two years of case management services, the study revealed that the services had significant effects on lowering the number of hospitalizations as well as increasing patients' symptom control and quality of life (Joo, 2014). Another meta-analysis of studies focused on the effectiveness of interventions implemented to improve care coordination to reduce health care utilization among frequent users of health care services was completed, resulting in 36 randomized controlled trials and 14 companion reports (Tricco et al., 2014). The study found that patients in the care coordination intervention group had fewer hospital admissions compared to those in the control group.

There are also mixed findings concerning case management and unmet medical needs. Heslen, Andersen and Gelberg (2003) conducted a cross-sectional study on 974 homeless women in Los Angeles county, CA examining the association of case management services with access to shelter, public assistance, and general medical care. They found that many of the homeless women with unmet medical needs actually had case managers. The researchers hypothesized that the utility of having case management may decrease as homeless women started establishing a regular source of care.

Need characteristics. These traditional and vulnerable predictors indicate participants' self-perceived illness and clinical assessments of the individual's health status (Gelberg, Andersen & Leake, 2000).

Importance of conditions to patient. Ledoux, Barnett, Garcini and Baker (2009) recruited 240 medical patients from general and specialty outpatient clinics and found that among patients with moderate to severe symptoms of anxiety or depression, perceived need for

mental health services was one of the psychosocial factors that significantly predicted recent mental health service use.

Comorbidity. In 2012, nearly half of all adults were diagnosed with one or more chronic conditions, and of this number more than half were managing multiple chronic conditions (Ward, Schiller & Goodman, 2012; Tinetti, Fried & Boyd, 2012). Data from the 2012 National Health Interview Survey reveal the following percentages for adults informed by a doctor or health professional that they had a chronic medical condition: obesity (28%); hypertension (24%); arthritis, gout, lupus, or fibromyalgia (21%); heart disease (11%); and diabetes (9%) (Blackwell, Lucas & Clarke, 2014). Clinicians often see and treat patients in hospitals and outpatient clinics who have as many as five to seven chronic conditions (Benjamin, 2010). Illness burden is highest with elderly populations who are managing on average five or more chronic conditions, filling 50 prescriptions, visiting 14 different physicians, and making 37 physician office visits per year (Warshaw, 2006).

Studies of patients with chronic medical illnesses consistently note the co-occurrence of other chronic conditions, particularly mental health conditions, negatively influence health outcomes. In a study of Veterans Affairs patients involved in a collaborative care intervention for chronic pain, Dickinson et al. (2010) found that participants in the intervention group, compared to usual care, had 16 additional pain disability-free days. Predictors of incremental costs increases included baseline medical comorbidities, depression severity, and prior year's treatment costs.

In a retrospective chart review of patients with cystic fibrosis (CF), Snell, Fernandes, Bujoreanu and Garcia (2014) found that depression was strongly associated with greater healthcare utilization and healthcare costs. Hospitalization rates of depressed patients were three

times higher compared to the non-depressed patients with CF and depressed patients incurred healthcare costs over four times the average of the non-depressed group. Patients were matched on gender, age, and lung function to control for these characteristics.

Pre-existing depression diagnosis. Pre-existing mental health disorders are found to be predictors of health service utilization. Among a population of homeless individuals, psychological distress was a significant predictor of higher illness, both directly and indirectly. However, psychological distress, also predicted fewer outpatient visits within this population (Stein, Andersen & Gelberg, 2007). Powers and Oltmanns (2012) studied an epidemiologically-based sample of Saint Louis residents ages 55-64 between two time periods that were 6 months apart. Results of their study revealed that the presence of personality disorders (PD) was a risk factor for decreased physical functioning, regardless of actual health status. PD was significantly predictive of worse physical functioning, role limitations, fatigue, and pain at both time points, after controlling for current health problems, depression, and health behaviors (i.e., smoking, drinking, and exercise). PD features were also predictive of increased healthcare utilization and medication use at the six-month follow up (Power & Oltmanns, 2012).

Initial depression severity is associated with depression levels at follow up. Angstman and colleagues (2012) completed a longitudinal retrospective analysis of 1,128 primary care patients participating in a DIAMOND-certified collaborative care depression management program in south-eastern Minnesota. The study found that patients with severe depression were less likely to attain clinical remission (PHQ-9 < 5) compared to the moderately severe and moderate depression groups (29.6%, 36.9%, and 45.6%, respectively). Also, among the unremitted patients, higher initial depression severity was significantly associated with higher six-month PHQ-9 scores. Those in the moderately depressed group had lower mean depression

scores at six months compared to those in the moderately severe and severely depressed patients (Angstman et al., 2012).

Model Variables not Included in the Predictive Model

A number of variables included in prior studies of the BMVP model are not included in the current study because these data were not available or were inconsistently collected given the administrative nature of the information found in the participating organization's insurance claims database. The variables not included are marital status, language proficiency, housing status, occupation, homelessness severity, risky sexual behavior and having a regular source of care (Gelberg, Andersen & Leake, 2000).

Program Process Characteristics Influencing Outcomes

This study also examines the relationship between process parameters of the intervention and each of the outcome measures. These parameters include number of contacts and most frequent type of contact (telephone versus face to face, FTF).

Number of follow up contacts (dose response). Dose-response effects are documented in treatment for adults with mental health conditions. Berg and colleagues (2014) studied inpatient admissions and emergency department visits among Medicaid enrollees with depression or schizophrenia in Illinois. Using administrative claims data of patients receiving disease case management services, they found that increased contacts lower the likelihood of all-cause inpatient admissions and emergency department visits.

Type of contact. Evidence is mixed regarding the effectiveness of disease management programs for chronic conditions achieving cost-savings (Lin et al., 2012). The type of medium used for delivery of depression care programs (telephone versus FTF) has not been well-studied in the collaborative care literature and in many programs the assumptions is that the telephone is as effective as FTF delivery (Mohr et al., 2012). To address concerns of access to care, such as

transportation and time to attend appointments, telephone contact may be a more effective medium of delivery. However, barriers to telephone contact with Medicaid members are identified in the literature. In a study of telephone-based health coaching with Medicaid members diagnosed with chronic conditions, the researchers noted 25% of the program members received no calls and 35% received only one or two calls during the two-year follow up period (Lin et al., 2012). Contact barriers included high turnover rate in Medicaid enrollment, frequent moves, and incomplete contact information (Lin et al., 2012).

Mohr et al. (2012) compared attrition and depression severity at post-treatment among 325 primary care patients participating in an 18-week cognitive behavioral therapy (CBT) treatment for depression. Participants were randomly assigned to telephone CBT (T-CBT) or face-to-face CBT. The study found lower attrition among the T-CBT group compared with face-to-face, and both groups had significant improvement in depression at six-month follow up, with no treatment differences. Although reductions in depression scores were found in both groups, the face-to-face CBT group was significantly less depressed than the T-CBT at six-month follow up, relative to baseline. Results indicate trade-offs between treatment adherence and maintenance of post-treatment gains depending on the medium of delivery.

LIMITATIONS OF THE EXISTING LITERATURE

Collaborative care primary care programs have gained mainstream acceptance as an evidence-based approach to managing patients with depression, however, findings are not universally positive. Long et al. (2014) found that in a population of veterans with comorbid diabetes and serious mental illness (SMI), patients on average had good glucose control and medication adherence regardless of whether they received primary care services in a clinic with co-located primary care and mental health services, or in clinics with primary care services only.

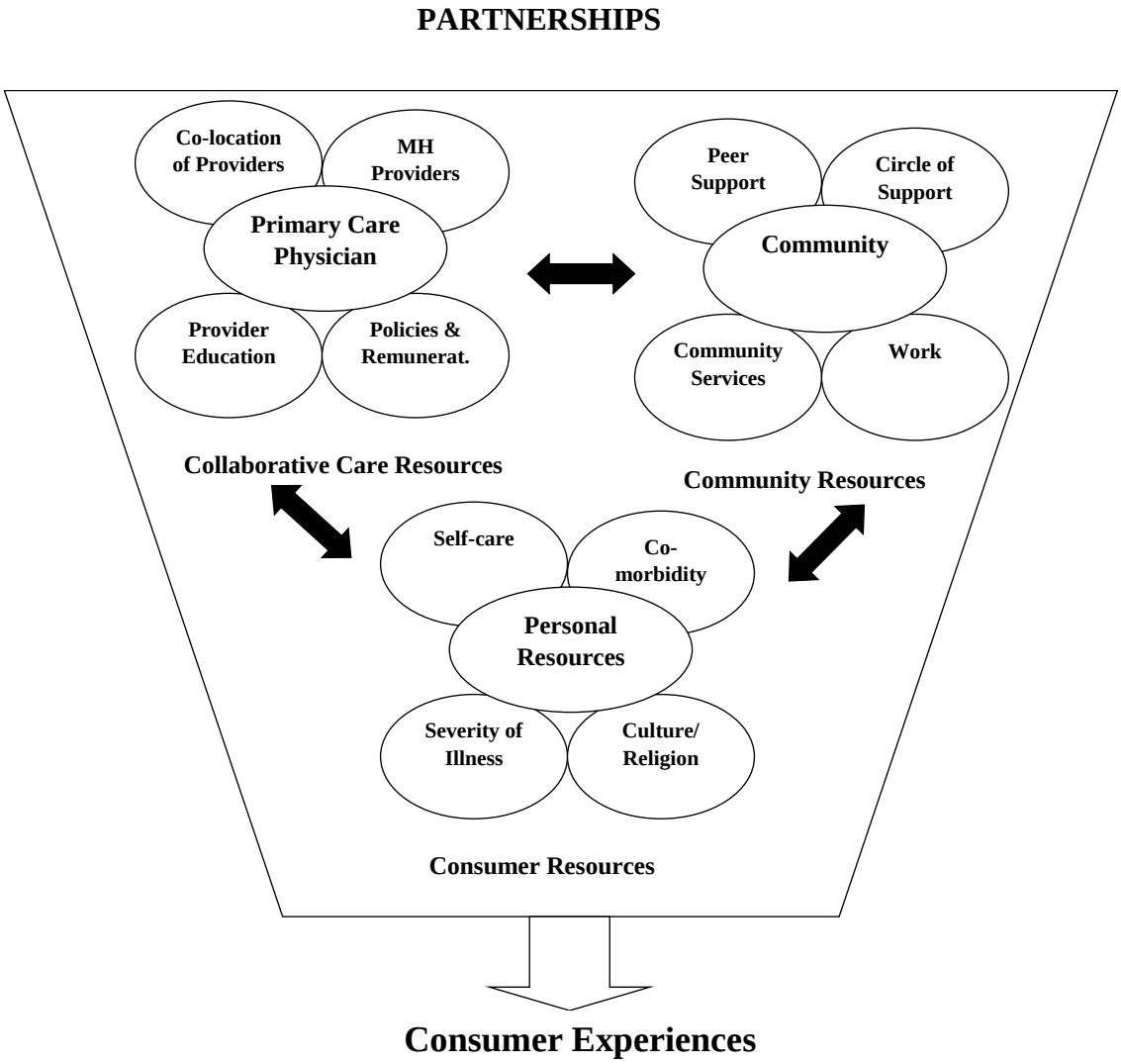
Although a trend toward better outcomes in those receiving co-located care existed, it was not statistically significant at the $p < 0.05$ level. Effective methods to identify and treat depression within the most appropriate settings are needed, yet a knowledge gap exists in understanding what aspects of collaborative care models for depression have been most effective over the years. To address this need, in 2011 key national leaders in the field convened at the Collaborative Care Research Network Research Development Conference, an Agency for Healthcare Research and Quality-funded event, to establish a research agenda among primary care and mental health clinicians (Miller, Kessler, Peek, & Kallenberg, 2011). As stated in the ensuing report, the existing knowledge on the extent and characteristics of collaborative care strategies is limited and there is not a consistent evaluation model with specified outcomes being used. The prescriptive agenda on collaborative care calls for research that promotes a better understanding of what strategies are having positive effects, or not, and for whom; and to build an organized knowledge base of what is currently being practiced in the field as collaborative care (Miller, Kessler, Peek, & Kallenberg, 2011).

At its roots, collaborative care models derive from a biopsychosocial approach to understanding the causes of illness. Health is viewed as a culmination of biological, psychological, and social factors that provide the context to an individual's health outcomes (Engel, 1977). Social determinants influence the resources and health status patients bring to the health care arena and the medical system primarily focuses on treating disease, therefore policymakers need to consider solutions that take into account the both types of interventions in reducing health disparities for vulnerable populations (Shi & Stevens, 2010). The need for multi-level approaches to evaluate healthcare interventions has been promoted by the Department of Health and Human Services' Healthy People 2010 and in the Institute of

Medicine's *Crossing the Quality Chasm* report (2001). Both of these seminal documents recognize the health care system as a complex adaptive system.

Research based on a pan-Canadian workshop that met to identify key attributes of collaborative care for mental health resulted in a preliminary consumer-centered framework for research and evaluation of such programs (McCusker et al., 2012). The work group was comprised of patients being treated for depression in a collaborative care program along with their family members, primary care and mental health practitioners, decision-makers, and the study researchers. Eight essential attributes that are important to patients and family members were identified: 1) respectfulness; 2) involvement of consumers in treatment decisions, 3) accessibility; 4) provision of information; 5) coordination; 6) whole-person care; 7) responsiveness to changing needs; and 8) comprehensiveness (McCusker et al., 2012). Thematic analysis also revealed three inter-related constructs that influence the consumer experience of collaborative care. Figure 3 depicts these three partnerships: a) organizational aspects of care, b) consumer characteristics and personal resources, and c) community resources, as important to consumers and help promote a more holistic approach to evaluating collaborative care programs.

Figure 3. Evaluation framework for consumer-centered collaborative care for depression



Source: McCusker et al. (2012). Developing an evaluation framework for consumer-centered collaborative care of depression using input from stakeholders. *Canadian Journal of Psychiatry, 58(3),* 160-168**.**

At this stage in the continued development of the collaborative care field, health service research is needed to identify characteristics of the programs and the populations that result in

appropriate health service use and desired health outcomes. Methodologies to evaluating and studying these programs are better suited if they reflect the medical, psychological, and socio-environmental approaches utilized in addressing the health needs of patients in these programs. Evaluations of collaborative care approaches have primarily focused on symptomatology, cost, and quality of life as outcomes, but very few have addressed the health care utilization patterns associated with these outcomes (Huffman et al., 2014). Models that can describe or predict utilization of services (e.g., inpatient admissions, emergency department, tests and procedures) to aid in the understanding of the unique needs of this population serve to increase the availability of appropriate medical and behavioral health services that are continuous, comprehensive, and more apt to be accessed, which is necessary given the complexities of caring for this population of people living with depression and other chronic medical conditions.

Significant limitations regarding the use of the Behavioral Model for Vulnerable Populations also exist. As a more recent revision to the well-known Health Service Utilization model, the BMVP has not been used specifically with a Medicaid population, even though the Medicaid population clearly fits the definition of a vulnerable population due to their lack of financial resources and/or disabilities which puts them at higher risk for negative physical, psychological, and social outcomes (Aday, 2001). This study will expand the population base in which the model has been applied. The BMVP has primarily been tested among homeless populations, even though other types of at-risk populations may have different predisposing, enabling, and need factors from the homeless or the relative importance of the same vulnerable predisposing, enabling and need factors may differ across different groups or healthcare environments (Stein, Andersen & Gelberg, 2007). Furthermore, the application of the BMVP has not been supported in all studies. Hogan et al. (2012) applied the model to describe

participation rates in an inter-conceptional care program, which is a preventive service for women at high risk of a subsequent preterm birth. The program addressed all commonly known barriers to care in order to ascertain factors that predicted observed levels of participation in this preventive care program. The researchers found that the BMVP did not explain variation in the program's participation rates.

This study will apply a framework developed for vulnerable populations to identify individual and community-level predictors of change in acute care and outpatient visits, and depression severity among collaborative care program participants. The study also seeks to determine the collaborative care program's effectiveness in producing desired outcomes among the program participants compared to a treatment as usual (TAU) cohort. Participants are all Medicaid beneficiaries.

This study has three primary aims:

1. To evaluate the program's within and between groups effects on depression severity, acute (i.e., inpatient and ED) services, and ambulatory services.
2. To apply a health service utilization model based on vulnerable populations to identify characteristics associated with acute and ambulatory services use and depression severity.
3. To examine process characteristics of the collaborative care for depression program's contacts between the behavioral health coaches and patients and changes in depression severity and patients' use of health services.

Chapter 3 discusses the study methodology, research questions, statistical analysis plan, and limitations of this study.

CHAPTER III

METHODOLOGY

This chapter identifies the study population, research questions and design, data source and collection, sampling methodology, study variables, hypotheses, statistical tests utilized, ethical consideration, and limitations in this study. All data used in this research are secondary data extracted from administrative claims and case management databases of a large commercial health insurance company with a Medicaid/Medicare subsidiary. The company is referred throughout the study as "the health insurance company." Variables were selected based on their representation of the theoretical model's constructs, characteristics of program processes, and the outcomes measured. Based on the Behavioral Model of Vulnerable Populations (BMVP), statistical tests were used to assess the effectiveness of a collaborative care for depression program on decreasing acute health service utilization and depressive symptoms, and increasing outpatient health service use. Statistical techniques were also conducted to analyze the association between program parameters and proposed outcomes.

ETHICAL CONSIDERATIONS

The data were handled in compliance with the Administrative Simplification section of the Health Insurance Portability and Accountability Act of 1996; the Privacy Act of 1974; the Institutional Review Board of Old Dominion University; 21 CFR 50 Protection of Human Subjects; 21 CFR Protection of Human Subjects; 32 CFR 219 Protection of Human Subjects, and the data use agreement with the health insurance company. This study was approved as an exempt study by the Institutional Review Board at ODU in May 2015. Precautions were taken by the primary investigator (PI) to mitigate risk to the health insurance company providing the data and its members, including use of password protected devices, locked file cabinets to store

printed data, and no personal identifying information being requested by the PI. Data were transferred via secure email protocols. Because the health insurance company providing the data stipulated requestors ask for a de-identified data set to protect their members' identify, randomly generated IDs were assigned to each individual prior to receipt of the data. The data used in this study were approved by the Compliance and Legal Offices of the health insurance company (see Appendix for approval response). Results display aggregated data only in order to prevent identification of any one individual. The data used in this study will be destroyed at the conclusion of the study, per the data use agreement and the Old Dominion University Institutional Review Board.

PARTICIPANTS AND SAMPLING FRAME

The population of interest includes Medicaid beneficiaries with depressive symptoms as determined through a Patient Health Questionnaire (PHQ-9) assessment and/or received a formal diagnosis of depression. Depression diagnoses met Diagnostic and Statistical Manual of Mental, Fourth Edition (DSM-IV, American Psychiatric Association [APA], 2000) criteria for major depressive disorder and depression not otherwise specified. Participants had administrative claims incurring between June 1, 2013 and June 30, 2015 for the Medicaid population living in non-institutional settings. The five sites participating in the collaborative care program whose patient data were utilized for this study are located in Maryland, Tennessee, and Texas. Four were primary care clinics and one was a home-based program provided by a primary care physician.

Participants in the intervention were already enrolled in Medicaid when the intervention began. They are part of the patient panels of the five participating clinics. During the intervention, staff at the primary care clinic provided behavioral health coaches (BHCs) with a

list of patients currently enrolled in the participating health insurance company with appointments on the days the BHCs were scheduled to be in the clinic. The members were approached by the BHCs before seeing their providers to receive a PHQ-9 depression severity assessment. Details on the PHQ-9 assessment tool are provided in the instrumentation section. The BHCs also contacted members with high risk scores for psychiatric case management needs by telephone to conduct the depression assessment and, if appropriate, discuss the intervention to ascertain their consent to participate. These risk scores, known as CI3 scores, are calculated based on criteria established by the participating health insurance company.

Initial data from all participants, enrolling in intervention between June 18, 2013 and September 30, 2014, reveal that 1,860 patients had been screened, of which 433 (23.3%) were within the clinical range for major depression (Johnson, 2014).

Medicaid members composing the control group were identified using propensity score matching. This technique has been increasingly applied to health sciences studies in which participants cannot be randomized into treatment conditions (West et al., 2014). Propensity scores provide a basis for equating groups on a number of covariates measured at baseline that are either related to the outcome variable or assignment to the treatment group (West et al., 2014). An individual's propensity score indicates their probability of receiving treatment, conditional on the covariates, using a logistic regression model (West et al., 2014).

Study Inclusion Criteria

The study utilized a census of all members who agreed to participate in the collaborative care for depression pilot program with start dates between June 1, 2013 and June 30, 2015. Members were between 18 and 67 years of age and have at least five and a half months of continuous coverage prior to the intervention to establish a minimum length of Medicaid

enrollment. A matched comparison group was identified from clinics not participating in the intervention within the same states as the intervention clinics. The comparison group received treatment as usual, per each state's health plan's guidelines for Medicaid Behavioral Health services. Because the comparison group did not have an index date or enrollment date, their index date was the same as their matched program participant's enrollment date. These criteria were used to make a data request of the health insurance company for the study.

Study Exclusion Criteria

Similar to existing studies involving treatment of adults with depression, exclusionary criteria for this study included individuals less than 18 years of age and over 67 years of age due to differences in the healthcare needs, cognitive and physical capacities, and resources available to pediatric and geriatric patients. Other exclusion criteria, based on program parameters, included: a PHQ-9 depression severity score of less than 10 at the potential enrollment visit (a score less than 10 is considered mild or non-clinical indication of depression), having less than five and a half months of continuous Medicaid prior coverage, and only having the PHQ-9 score from the initial enrollment visit (i.e., index visit).

SETTING

The company supporting the collaborative care for depression pilot program and providing the data for the study is a large health insurance company headquartered in Indianapolis, Indiana. One of the company's subsidiary organizations is a Medicaid/Medicare managed care organization (MCO) based in the Hampton Roads, Virginia area that was acquired in 2014. This affiliated company serves more than 4.5 million Medicaid, CHIP, Medicare, and Long-term Care beneficiaries in 19 states. It is within the Behavioral Health department of the subsidiary MCO that the collaborative care program is centrally managed.

At the health plan, the team managing the intervention consists of a director, five masters level social workers, a consulting psychiatrist, a consulting clinical psychologist, and a program administrator. The five-year collaborative care program began in January 2013 and is expected to continue through December 2017. In MD, intervention participants came from a federally-qualified health center; in TN, from a family medicine clinic affiliated with a medical school; and in TX, from a family medicine clinic also affiliated with a medical school. The first members were enrolled in Maryland in June 2013, followed by Texas in August 2013, and Tennessee in September 2013 (Johnson, 2014). The BHCs, typically master's level social workers, were co-located within select primary care offices to engage in systematic screening, diagnosis, and collaboration with participating program participants and providers. BHCs provided evidence-based patient care coordination; brief behavioral intervention; and support treatments initiated by the primary care provider, including medication (Johnson, 2013).

Each of the three sites had similar state-specific Medicaid eligibility requirements during the study time period, even though the actual maximum monthly income allowed differed by state. All Medicaid recipients had to be a resident of that state and either a U.S. citizen or a qualified alien with state-specific citizenship status requirements. Maryland's Medicaid requirements are based on recipients belonging to at least one of the groups of people covered by Medicaid and income limits based on family size (Dept. of Health and Mental Hygiene [DHMH], n.d.). Broadly, there are two groups of Medicaid recipients in Maryland, the "Aged, Blind and Disabled" and "Families and Children" (DHMH, n.d.). Tennessee's eligibility requirements are also specific to specific income limits, and groups such as women who are pregnant, parents with a minor child, women with breast cervical cancer, people receiving Supplemental Security Income, and those living in nursing homes or other long term care

services within income limits (TennCare, n.d.). Within Texas, similar maximum monthly income limits are required to qualify for Medicaid, as well as belonging to a covered group including pregnant women, women with breast or cervical cancer, adults caring for children, transitioning foster care youth, those 65 years or older in long term care or on SSI, people or household family member with disabilities (Texas Health and Human Services, 2017). Of the three sites, Baltimore county, Maryland was the most economically distressed county (D. Johnson, personal communication, April 4, 2017). Maryland is also the only state of the three in which behavioral health services are "carved-out", meaning both the mental health and substance use disorders services are managed by a separate fee-for-service system and through an Administrative Service Organization (Maryland Department of Health, n.d.).

Treatment as Usual (TAU)

Patients in the TAU group received behavioral health services the same as they had prior to the implementation of the collaborative care program within their state's Medicaid health plan. Treatment was based on the clinical decision-making of the patients' providers and varied by each state's Medicaid health plans. Federal guidelines mandate all Medicaid programs offer a broad range of services for mental health and substance abuse disorder conditions, including outpatient services such as individual and group therapy, partial hospitalization, and case management; inpatient services, such as residential treatment and detoxification; medications for diagnosed psychiatric disorders; and home and community-based services (Zur, Musumeci & Garfield, 2017). At the time of the study, services covered by the Medicaid managed care health insurance company followed the behavioral health care guidelines of the Milliman Care Guidelines (MCG), a private company that develops decision support tools for utilization management (MCG Health, 2017, www.mcg.com/).

Collaborative Care for Depression Pilot Program Description (Intervention)

The program under study is modeled after an evidence-based program known as the Improving Mood-Promoting Access to Collaborative Treatment (IMPACT) model developed by clinicians and researchers with the AIMS Center at the University of Washington (Unutzer et al., 2002). The IMPACT program was initially implemented in 2001 (Hunkeler et al., 2006). It is a forerunner in delivering the components of collaborative care models, which include the addition of a behavioral health coach, who is usually a master's level social worker or nurse, and a consulting psychiatrist within the existing provider structure at participating primary care clinics. The additional behavioral health staff engage in systematic screening, diagnosis, and collaboration efforts with providers to treat the primary care members' depression. The original IMPACT studies primarily focused on older adults with depression in managed care primary care settings and have consistently supported findings of decreased depression remission, improved functional status, and better quality of life among the intervention participants in both short and long-term post treatment follow ups (Hunkeler et al., 2006). During the last 20 years, collaborative care programs have been utilized with all age groups, including adolescents, and introduced to specialty medicine, OB/GYN clinics, community-based health centers, and schools with positive results (Katon, Unutzer, Wells & Jones, 2010).

Congruent with the IMPACT program, the intervention under study is a co-located, integrated depression management program in primary care (Johnson, 2014). The stated goals of the intervention are "to improve the detection, diagnosis, treatment and ongoing management of persons experiencing depression or substance use condition. By improving the management of a person's depression/SUD health is improved, including other co-occurring conditions; the

person's health service experience is enhanced; the practice improves quality scores (HEDIS); and health services costs are lowered" (Johnson, 2014).

At the time of the study, primary care clinics in Maryland (MD), Tennessee (TN) and Texas (TX) had recently started implementing the intervention. The BHCs were direct hires within the participating health insurance company and co-located within participating clinics. BHCs were trained by the program director and appropriate health insurance company staff in the administration of assessments and other data collection instruments, as well as the case management reporting tool. Each clinic established a screening protocol for administering the PHQ-9. In some cases the clinic's Medical Assistant at the reception desk provided the PHQ-9 in paper copy to Medicaid members covered by the insurance agency, which were then reviewed by the BHC. In other clinics, the BHC administered the PHQ-9 to the member in the examination room. The screening was presented as a part of the clinical practice and for those individuals scoring 10 or higher the BHC completed a brief assessment and talked with the individual and the physician about ongoing care and follow-up. Thus, during the initial contact (index visit) members were assessed for depression and substance use disorders (SUD) using the PHQ-9 and AUDIT-C forms, respectively, prior to their appointment with their primary care physician. Members' scores were entered into the case management computerized system. If their PHQ-9 scores fall within the clinical range of moderate to severe major depression (total score $\geq$ 10), the BHCs discussed the collaborative care program with those members. If they agree to participate, they are followed up to one year by the BHC assigned to the participant's primary care clinic.

Treatment and BHC activities were structured to be consistent with the individual's preferences, adjusting treatment based upon the patient's response and engaging in active follow-up and goal-oriented coaching. Participants were re-assessed with the PHQ-9 at each follow-up

appointment for tracking and monitoring purposes. Results were discussed with primary care provider and intervention team to address the need for treatment modifications. Depending on the patients' scores and overall progress, the frequency of follow up visits increased or decreased as determined by the BHC and in consultation with a consulting psychologists and psychiatrist. Follow-ups were ongoing during the acute and continuation phases of treatment, and became less frequent during the maintenance phase to prevent relapse (Johnson, 2014).

The BHCs' relationships with the primary care team and the members were significant to the success of the collaborative care program. Their roles included the following:

- Screen patients for depression, other common mental health conditions, alcohol and/or drugs use and other life stressors.
- Responsible for patient engagement and education for patient self-management.
- Keep consistent, pro-active follow up with patient through face to face, phone or other electronic contact.
- Weekly review of all patients who are not improving as expected with PCP and psychiatric consultant.
- Facilitates communication between providers, health plan personnel and patients as needed.
- Facilitate referrals for external specialty care such as mental health, substance abuse and social services.
- Collaborate with patient to develop a behavior activation plan, make changes with patient as needed and consult with providers as needed.
- When patient behavior activation plan shows measurable patient improvement, develop a relapse prevention plan with patient.
- Responsible for documentation, monitoring of symptom improvement and data collection.

INSTRUMENTS AND DATA

The study used secondary data sources. Administrative claims and case management data from the study participants were abstracted by analysts from databases owned and managed by the health insurance company. Age, gender, geographic information, and information regarding inpatient stays, ED visits, and outpatient visits were obtained from member Medicaid

claims data. The remaining study variables were obtained from the company's case management database.

Patient Health Questionnaire–9 Items (PHQ-9)

The PHQ-9 is a brief nine-item depression assessment tool derived from the depression module of the full three-page Patient Health Questionnaire (PHQ, Kroenke, Spitzer & Williams, 2001). Items on the assessment are based on the nine diagnostic criteria for major depressive disorder from the DSM-IV (AIMS Center, 2015). It is the key assessment tool used in the IMPACT model. This psychometrically valid brief assessment tool is used for screening, aiding in diagnosis, monitoring, and measuring depression severity frequently in primary care settings (Kroenke, Spitzer & Williams, 2001). Patient scores can range from zero to 27 as each item can have a maximum score of three. The internal reliability of the PHQ-9 is high, the Cronbach's alpha = 0.89 (Kroenke, Spitzer & Williams, 2001). A strong negative association exists between the composite PHQ-9 score and the functional status scores of another well-accepted medical outcomes survey, the Short Form 20 (SF-20), in particular the mental health (0.73) scale, validating its construct validity (Kroenke, Spitzer & Williams, 2001). All scores from the member's index visit up to six months post the index date were collected. PHQ-9 data are available for intervention participants only.

Initial and Follow-Up Visit Assessments

Program participants were asked questions from the electronic assessment form at their initial and follow up visits. Items on the assessment form captured self-reported data on their depression severity, and substance use, goal-setting, health behaviors and attitudes, and BHC and PCP treatment plans.

Specifically, data were collected on at least one occasion (i.e., index visit) on the following:

- PHQ-9 depression severity scores
- AUDIT-C alcohol scores (3-item screening tool for alcohol use disorders and risk drinking)
- Substance use disorder screening tool – 8 items on illegal drug use and prescription drug use
- use of depression medication
- Bipolar rule out
- importance of behavioral issue(s) to the participant
- confidence in taking action with these issues
- risk of violence/self-harm
- setting of health goals and improvement in those goals at follow ups
- participant response to treatment
- medication adherence
- participant's knowledge, support, and attitude regarding next steps
- PCP's treatment plans
- BHC intervention activities during appointment
- plan for follow up meeting
- appointment length in minutes

STUDY DESIGN

This study incorporated a pre-test post-test quasi-experimental design with a matched equivalent control group. An intention to treat method was used because Behavioral Health Coaches continued to attempt contacting participants during the six-month follow up period, regardless of whether or not the calls were returned. The intervention under study is a primary care collaborative care pilot program for patients with Medicaid coverage who were assessed to have depressive symptoms using a self-reporting tool, the PHQ-9. The program had been implemented prior to the start of the study, therefore random sampling and random assignment were not possible.

STATISTICAL ANALYSIS PLAN

Data were analyzed using IBM SPSS version 24.0 for descriptive and inferential statistics. Data on study patients meeting criteria were provided by the participating health insurance company for those who participated in the intervention between June 1, 2013 and June

30, 2015 and their matched cohort. The one-to-one propensity score matching technique with nearest neighbor matching and no restrictions on the difference between the propensity scores of the matched pairs was used to identify a comparable treatment as usual (TAU) group (Austin, 2011). The covariates age, gender, state of services, illness severity risk score, and case management status were included in the binary logistic regression model. Because the intervention participants were identified as within the range of clinical depression using the PHQ-9 depression severity assessment tool, the pool of potential TAU patients required the inclusion criteria of an ICD-9 depressive diagnosis, resulting in 17,195 potential matches from TN, TX, and MD. Once the closest optimally matched TAU patients were identified, a request was made of the their claims counts categorized as pre and post inpatient (IP) stays, emergency department (ED) visits, and outpatient (OP) visits, each further delineated as behavioral health or physical health services, for both the intervention and TAU groups. Claims counts from the six months prior to index enrollment date (pre period) and six months after index enrollment date (post period) were analyzed. In total, there were 236 intervention patients and 208 TAU patients with available claims data.

Prior to analysis of the data for hypothesis testing, data were screened for missingness and the dependent variables were examined for outliers. To evaluate the pattern of missing data, the Little's Missing Completely At Random (MCAR) test using EM estimation was used with CI3 illness severity; age; depression severity index score; comorbidity score; number of contacts; race; case management; and number of IP, ED, and OP claims during the prior six-month period. The results indicated the pattern of missing data were not completely at random ($p = .000$), therefore use of imputation methods was recommended (Garson, 2015). In order to keep as full a sample size as possible, and to use certain key predictor variables for propensity score

matching used in the between groups analysis, the multiple imputation method was used with the CI3 score and case management variables. The CI3 score, which is an index of how sick or costly the member is expected to be compared to the average insured member, and the case management variable each had 3.2% and 3.4% missing data, respectively. The outliers were addressed by winsorizing the data, which involves replacing the outlier value with the next highest value within three standard deviations of the mean (Field, 2013). Outliers were identified in the change in PHQ-9 depression severity, pre period outpatient behavioral health, and pre period outpatient physical health visits.

To test within group differences in depression severity from pre to post-enrollment periods, dependent samples *t*-tests were used. To test within group differences in IP, ED, and OP health services, the Wilcoxon matched-pair signed-rank test was used because data were determined to be not normally distributed. To address the main research questions, a series of multivariate logistic regression models were conducted to estimate the likelihood of 1) decreasing depression severity, and 2) maintaining or decreasing inpatient and ED encounters, and 3) increasing outpatient visits. Each of these outcomes was modeled as a function of the Behavioral Model of Vulnerable Populations characteristics. Depending on the research question, predictors of interest in the models included the intervention group, the interaction of comorbidity and intervention group, and mode of delivery.

Hypothesis Testing

To address the aims of the study, five research questions and 13 hypotheses were developed and tested. Univariate and multivariate statistical techniques were conducted.

Research Question 1a. Does a within group difference exist in depression severity among the intervention group?

Hypothesis 1a. Participants in the intervention-only group will have significantly lower PHQ-9 depression severity scores at the six-month follow-up visit compared to their PHQ-9 score at time of enrollment. A dependent samples t-test was used to test hypothesis 1a.

Research Question 1b. Do within group differences exist in health services use among the intervention and TAU groups?

Hypothesis 1b. The number of inpatient stays and ED visits of the intervention participants during the six month period after their index enrollment date will be significantly lower than their six month pre period claim counts; whereas their post period outpatient visits will be significantly higher. Examination of the inpatient and emergency department utilization data revealed non-normality in the distribution of pre and post enrollment-date claims counts. The non-parametric Wilcoxon signed-rank test was used to test hypothesis 1b.

Research Question 2a. Are Medicaid participants of the intervention program less likely to increase their inpatient stays and ED visits, and more likely to increase their outpatient visits from pre to post periods, compared to members receiving usual care for depressive disorders?

Hypothesis 2a. After controlling for confounders, intervention participants will be less likely to increase their inpatient stays and ED visits, and more likely to increase their outpatient visits between pre and post index dates compared to Medicaid members receiving usual care for diagnosed depressive disorders. Multivariate logistic regression analysis was used to test hypothesis 2a.

Research Question 2b. Is the interaction between group and level of comorbidity a significant predictor of health services use during the post-enrollment period?

Hypothesis 2b. After controlling for confounders, the interaction between treatment group and level of comorbidity is a significant predictor of health service use during the six month period after index enrollment date. Multivariate logistic regression analysis was used to test hypothesis 2b.

Research Question 3a. Using the Behavioral Model for Vulnerable Populations (BMVP) as a framework, what are the significant predictors of health service use among the intervention participants during the six months of follow up?

Hypothesis 3a. Among the intervention participants, a significant association exists between predisposing, enabling, and need characteristics and change in health services use between the six-month pre and post enrollment periods. Multiple logistic regressions were conducted using the identified twelve variables to determine if they predicted change in use of each of the health service types and depression severity during the six month follow up.

Research Question 3b. Using the BMVP as a framework, what are the significant predictors of decreased depression among the intervention participants during the six months of follow up?

Hypothesis 3b. Among the program participants, a significant association exists between predisposing, enabling, and need characteristics and change in depression severity scores between the six-month pre and post periods after enrollment in the collaborative care program. Multiple multivariate logistic regressions were conducted to identify predictors of change in depression severity.

Research Question 3c. Among the intervention participants, does a significant association exist between the change in depression severity and change in health services used during follow up?

Hypothesis 3c. Among the intervention participants, a significant association exists between the change in depression severity and change in inpatient stays, ED visits, and outpatient visits from pre to post enrollment date, after controlling for confounders. Multivariate logistic regression was utilized to examine the relation between change in depression severity and change in health services utilization.

Research Question 4a. Which predictors of the BMVP framework are associated with achieving a clinical reduction in depression severity?

Hypothesis 4a. Among the intervention participants, those who achieved a clinical response in their depression severity differ significantly in predisposing, enabling, and need characteristics from those who did not achieve a clinical response.

Research Question 4b. Is achievement of a clinical reduction in depression predictive of changes in health services use?

Hypothesis 4b. Among the intervention participants, depression severity status predicts change in health service use, after controlling for confounders.

Research Question 5. Among the intervention participants, are there statistically significant associations between characteristics of the behavioral health coaching sessions (i.e., number of contacts and medium of delivery) and changes in depression severity and health service use?

Hypothesis 5a. The number of follow up contacts is associated with change in depression severity during follow up, after controlling for confounders.

Hypothesis 5b. The number of follow up contacts is associated with change in health service use during follow up, after controlling for confounders.

Hypothesis 5c. The type of contact is associated with change in depression during follow up, after controlling for confounders.

Hypothesis 5d. The type of contact is associated with change in health service use during follow up, after controlling for confounders.

STUDY VARIABLES

This study uses the Behavior Model for Vulnerable Populations (BMVP) as a framework in conducting a quasi-experimental analysis and a predictive analysis. The analysis involving use of the BMVP in the predictive analysis uses data from the intervention participants only. Much of the case management data (e.g., follow-up visits, PHQ-9 scores, psycho-social items) were only available for Medicaid enrollees participating in the collaborative care intervention. A listing of which data were available for intervention and/or control group members is given in the tables. The following tables discuss the explanatory variables.

Population Characteristics of the Behavioral Model for Vulnerable Populations

Table 1 describes the factors to be studied that are associated with the Predisposing construct of the Behavioral Model for Vulnerable Populations. Traditional and Vulnerable characteristics have been identified in accordance with the theoretical framework.

Table 1

BMVP Predisposing Construct Factors in Study

Variable	**Description**	**Level of Measurement**	**Available for both intervention and control group? (Yes/Int. only)**
Traditional			
Age	Age in years at time of enrollment in PC-INSITE (> 18 years and less than 68 years)	Ratio	Yes
Gender	Male/Female	Dichotomous	Yes
Race*	0=Asian/Caucasian; 1=African-American; Latino/Hispanic; Other	Dichotomous	Yes

Table 1 Continued

Variable	Description	Level of Measurement	Available for both intervention and control group? (Yes/Int. only)
Vulnerable			
Substance Use Disorder	'Yes' if claims diagnoses from the 6-month period prior to their enrollment date include International Classification of Diseases (ICD-9) codes: 291,303, 304, 305.0,305.2–9, 265.2,357.5,571.0–3, 425.5, 535.3, 790.3,and E860.0–1; Otherwise, 'No'	Dichotomous	Yes
DSM-V depressive disorder diagnosis on claims within 12 months prior to enrollment date or index date for TAU group	0 = No; 1 = Yes ICD-9 codes associated with depressive disorders, chronic depressive personality disorder, and bipolar disorders. Including codes 296.2*, 296.3*, 296.8*, and 301.12. *Note: '*' indicates a wildcard symbol to include all related codes.*	Dichotomous	Yes
Risk of Violence from Others	Within the past year have you been hit, slapped, kicked or otherwise physically hurt by someone? 0=No; 1=Yes	Dichotomous	Intervention Only

Table 1 Continued

Change in self-rating of confidence to take action with conditions during 6 months	Increased (2); No changes or Decreased (1)	Dichotomous	Intervention Only

*Asian race was combined with Caucasian due to low sample size. Analysis of Medical Panel Expenditure Survey data report similar rates of income >400 FPL and self-reported mental health status, and higher educational attainment compared to Whites (Cook et al., 2017).

Table 2 describes the factors associated with the Enabling Resources construct of the Behavioral Model for Vulnerable Populations. It is within this construct that treatment status (i.e., intervention participant) is classified.

Table 2

BMVP Enabling Resources Construct Factors in Study

Variable	**Description**	**Level of Measurement**	**Available for both intervention and control group? (Y/N)**
Traditional			
Physician density in county	0=TN/TX (lower provider density); 1=MD (higher provider density)	Dichotomous	Yes
Vulnerable			
Group Status	0=Control 1 = Intervention	Dichotomous	Yes
Case Management	0=No 1=Yes	Dichotomous	Yes

Table 3 describes the factors that were examined under the Need construct of the Behavioral Model for Vulnerable Populations.

Table 3

BMVP Need Construct Factors in Study

Variable	**Description**	**Level of Measurement**	**Available for both intervention and control group? (Y/N)**
Traditional			
Prior IP stays (broken out by medical or behavioral)	Number of inpatient admissions during the 6 months prior to index enrollment date	Ratio	Yes
Prior ED visits (broken out by medical or behavioral)	Number of ED visits during the 6 months prior to index enrollment date	Ratio	Yes
Prior Outpatient visits (broken out by medical or behavioral)	Number of OP visits during the 6 months prior to index enrollment date	Ratio	Yes
Pregnancy	0=No; 1=Yes Primary diagnosis related to pregnancy during the 6 months prior to index enrollment date (ICD 9 codes 630.* - 679.* and V22.*). *Note: '*' indicates a wildcard symbol to include all related codes.*	Nominal	Yes

Table 3 Continued

Variable	Description	Level of Measurement	Available for both intervention and control group? (Y/N)
Importance of conditions to patient at index visit	At this time, on a scale from 0 to 10 how important is the above noted issue/condition/problem?	Ratio	Intervention Only
Baseline Chronic Illness Intensity Index (CI3)	Proprietary tool that uses an algorithm to determine how sick or complex the member is expected to be compared to the average insured member using demographic, diagnostic, and pharmacy data (MHPA, n.d.)	Ratio	Yes
Vulnerable			
Level of comorbidity	Charlson Comorbidity Index*	Ordinal	Yes
PHQ-9 score for depression at index	Between 10-27; 10 is the minimum because it indicates clinical level of depression	Ordinal	Intervention Only

*An age-weighted Charlson Comorbidity Index was calculated based on the published weights of the 17 chronic conditions and an additional 1 point for every decade over 50 years of age (Charlson, Pompei, Ales & MacKenzie, 1987; Radovanovic et al., 2014).

Characteristics of Follow-Up Visits

The variables in Table 4 are not included in the Behavioral Model for Vulnerable Populations constructs. They were used in a separate analysis to examine the association between characteristics of the follow-up visits and each outcome variable. They were only available from the intervention participants.

Table 4

Process Variables Related to Follow-up Visits

Variable	**Description**	**Level of Measurement**	**Available for both intervention and control group? (Yes/Int. Only)**
Number of BHC-member follow-up contacts	Continuous variable; these include contacts where PHQ-9 scores were assessed and do not include impromptu contacts with the members	Ratio	Intervention Only
In-person or telephone (predominantly) follow-ups	Bivariate variable: 1 = more than 50% visits were in person; 2 = more than 50% visits were over the phone	Dichotomous	Intervention Only

Dependent Variables

The dependent variables included in this study are described in Table 5. Outcome variables encompass health service utilization and, in research questions pertaining to intervention participants only, depression severity was also included as an outcome.

Health Outcome: Health Behavior Construct

Table 5

Use of Health Services Variables

Variable	**Description**	**Level of Measurement**	**Available for both intervention and control group? (Yes/Int. Only)**
Inpatient stays (combined physical or behavioral)	0=Increased; 1=Decreased/No Change	Dichotomous	Yes
ED visits (broken out by physical or behavioral when possible)	0=Increased; 1=Decreased/No Change	Dichotomous	Yes
Outpatient visits (broken out by physical or behavioral)	0=Increased; 1=Decreased/No Change	Dichotomous	Yes

Health Outcome: PHQ-9 Severity Depression

The PHQ-9 scores taken at the index visit and during the six-month follow-up period were used to measure changes in depression severity during the six-month treatment period. The data are ordinal and member scores and will have values between 10 and 27 to indicate clinical levels of major depression. PHQ-9 scores are only available for intervention participants as part of the screening process. Because an intention to treat method was used the last PHQ-9 score

obtained after the initial enrollment score was used, whether or not it occurred at the six-month follow up. For those participants who did not maintain contact with the Behavioral Health coaches during the post-measurement period, it was assumed that their scores did not change from their most recent score after enrollment. A clinically significant response/improvement was defined as at least a 50% reduction in depression severity scores when taking the difference between the last and index visit scores.

CHAPTER IV

RESULTS

Results of the hypothesis testing for each research question are presented in this chapter. Depending on the hypotheses being tested, different sub-samples of the full sample of participants were used. Table 6 provides a high-level view of which sub-samples were used with each analysis. Detailed discussion of why each sub-sample was used is provided in the Results of Research Questions sections.

Table 6

Samples Used for Each Analysis

Research Questions	**Full sample of matched Intervention and TAU patients** (*N*=444)	**Matched sample of patients with existing ICD-9 depressive diagnosis** (*n*=198)	**Intervention-only patients, all with PHQ-9 depression severity scores** (*n*=236)
Descriptive Analyses	●		
1 (a, b)	●		●
2 (a, b)		●	
3 (a, b, c)			●
4 (a, b)			●
5 (a, b, c, d)			●

DESCRIPTIVE ANALYSES

Table 7 depicts the demographic characteristics of patients in the intervention and TAU groups. Overall, both groups were similar across most demographic variables, including gender, race, age, chronic illness intensity index (CI3), case management at index visit, and health plan membership. Although propensity score matching was utilized using a limited number of demographic variables prior to obtaining the full sample, the two groups differed significantly in ICD-9 diagnosis of a depressive disorder, existing substance/alcohol use diagnosis prior to the

index date, and Charlson Comorbidity Index scores (Table 7). In order to create more comparable intervention and TAU groups, these group differences were addressed prior to conducting analysis of health services use outcomes and were discussed in the corresponding section.

As Table 7 reveals, participants in both the intervention and TAU groups were predominantly female (68.2% and 67.3%, respectively); in their early forties (*M*=43.1 and 42.4 years, respectively); black (69.1% and 72.6%, respectively); and from Maryland health plan (53.0% and 55.8%, respectively). Less than half of the intervention participants were receiving case management services at the time of their index enrollment visit. Both groups generally were not severely medically ill, as depicted by their CI3 scores and Charlson Comorbidity Index. Over half of the intervention participants had one or two assessment follow ups with their BH coaches during the six months of post-index follow up.

Table 7

Demographics of Full Sample Study Participants as a Percentage of Treatment Group (N=444)

Demographics	Intervention *n=236*	%	TAU *n=208*	%
Gender	236		208	
Female	161	68.2	140	67.3
Male	75	31.8	68	32.7
Age in years	M=43.13	S.D.=12.40	M=42.39	S.D.=11.78
18 - 33	62	26.3	53	25.5
34 - 49	89	37.7	89	42.8
50 - 69	85	36.0	66	31.7
Race				
Black	163	69.1	151	72.6
White	41	17.4	38	18.3
Other	20	8.5	19	9.1
In Case Management at index visit	102	43.2	98	47.1
Illness Severity (CI3)	*M*=4.17	*S.D.*=4.11	*M*=3.73	*S.D.*=3.82
Charlson Comorbidity Index[1]	*M*=1.56	*S.D.*=1.95	*M*=2.10	*S.D.*=2.81
0	117	49.6	96	46.2
1	60	25.4	49	23.6
2	20	8.5	13	6.3
3 and higher	39	16.5	50	24.0
Health Plan				
Maryland	125	53.0	116	55.8
Tennessee	87	36.9	80	38.5
Texas	24	10.2	12	5.8
Existing Depression diagnosis[2]	108	45.8	208	100.0
Existing Alcohol/ Substance Use diagnosis[3]	146	61.9	94	45.2
Pregnancy during study period	22	9.3	15	7.2
No. of BH coach post-index contacts				
1	73	30.9	N/A	N/A
2	49	20.8	N/A	N/A
3	47	19.9	N/A	N/A
4 or more	67	28.4	N/A	N/A

[1]Charlson Comorbidity Index higher in TAU (*p=.02*); based on age-weighted comorbidity score

[2]All TAU participants had an existing ICD-9 depressive diagnosis as inclusionary criteria;

Chi square test supports expected counts difference between groups (*p* =.00)

[3]Chi square test reveals intervention participants more likely to have an existing SUD/Alcohol use diagnosis (*p=.00*).

Table 8 provides descriptive statistics for the two outcome variables used to address the research questions: 1) health service utilization and 2) depression severity. For both the intervention and TAU groups, the acute care services (inpatient and emergency services) were infrequently utilized during the twelve-month period covered in the current study. Outpatient visits for physical health services were the highest utilized services. In comparing the two groups on health services use pre to pre and post to post periods, the TAU group used significantly more health services. A Pearson chi-square test revealed that TAU participants were significantly more likely to have one or more inpatient stays ($\chi^2(1, N = 444) = 5.72, p = .02$) compared to the intervention group. Independent samples *t*-tests revealed the TAU group attended significantly more outpatient behavioral health visits (M=6.26, M=1.93, TAU vs. intervention; p<.001) and physical health visits (M=26.34, M=16.66, TAU vs. intervention; p<.001) during the pre-enrollment period compared to those in the intervention. Independent samples *t*-tests also revealed post-enrollment outpatient behavioral health visits (M=5.67, M=2.29, TAU vs. intervention; p=.01) and physical health visits (M=24.70, M=19.10, TAU vs. intervention; p=.05) were significantly higher among the TAU group compared to the intervention. Use of emergency department services was not statistically different between the two groups.

Overall comparison of the within groups' change in health service usage from pre to post revealed an increase in service use by the intervention group and a decrease in use by the TAU group. Significance testing of these differences was the focus of the first research question therefore results are described in the following Results of Research Questions section.

Table 8

Percent of Pre and Post Period Health Service Utilization for Both Treatment Groups (N=444)

Type of Service Utilization	Intervention (*n*=236)		TAU (*n*=208)	
	Pre %	Post %	Pre %	Post %
Inpatient Stays (1 or more)	12.3	16.1	20.7	19.7
Emergency Dept. Visits (1 or more)	54.7	53.8	57.2	50.5
Outpatient Visits				
Behavioral Health				
None	75.4	72.0	56.3	61.1
1 - 10	17.8	20.3	24.5	27.9
11 - 25	5.1	5.9	10.1	4.8
26+	1.7	1.7	9.1	6.3
Physical Health				
None	1.3	3.8	4.3	5.8
1 - 10	53.0	44.5	31.7	34.1
11 - 25	30.1	28.0	28.8	28.4
26+	15.7	23.7	42.3	31.7

The outcome variable depression severity was only routinely collected with the intervention participants because it was used to assess appropriateness for the collaborative care for depression in primary care pilot program as well in applying stepped care in determining course of treatment. Depression severity as collected by the PHQ-9 assessment tool was not generally collected on all patients covered by the health insurance organization, unless required for specific case management programs. The PHQ-9 depression scores from the initial intake visits, referred to throughout this study as index visits or enrollment visits when referencing intervention-only participants, fell within the lower limits of the moderately severe depression range (Table 9). The average depression scores during the six month post-index period were in the moderate depression range (Kroenke, Spitzer & Williams, 2001). The PHQ-9 cut-point

scores occur at 5, 10, 15, and 20 and translate to mild, moderate, moderately severe, and severe depression, respectively (Kroenke, Spitzer & Williams, 2001).

Table 9

Means of Depression Scores, Intervention Participants Only (n=236)

Outcome	Min	Max	Mean	S.D.	Median
First Depression Score	10.00	27.00	15.30	4.11	15.00
Last Depression Score	0.00	27.00	13.02	5.33	12.00
Change in Depression Scores	-16.00	22.00	2.28	4.72	0.00
Average Depression Score	1.86	27.00	14.01	4.24	13.73

Note1: PHQ-9 scores only available for intervention participants.

RESEARCH QUESTIONS AND HYPOTHESES TESTING

Results of Research Question 1

Research Question 1a. Does a within group differences exist in depression severity among the intervention group?

Hypothesis 1a: Participants in the intervention-only group will have significantly lower PHQ-9 depression severity scores during the six-month follow-up visit compared to their PHQ-9 score at time of enrollment.

Hypothesis 1a results.

First and last PHQ-9 scores were tested for normality through inspection of the normal Q-Q plots and the kurtosis and skewness statistics, intervention participants only. For last PHQ-9 scores, skewness and kurtosis values were .00 and .01, respectively. First PHQ-9 scores skewness and kurtosis values were .53 and -.69, respectively. The dependent samples *t*-test

revealed that the intervention participants' (PHQ-9) depression severity scores were lower at their last contact with their behavioral health coach (*M*=13.02, *SD*=5.33), compared to their index (initial) visit score (*M*=15.30, *SD*= 4.11). This mean difference, -2.28, *95% CI* [1.67, 2.88], is statistically significant *t*(235)=7.42, *p* <.001, and represents a medium effect size, *d*=.56 (Cohen, 1992). Participants who were in the depression management intervention had statistically lower depression severity scores at their last visit compared to their index visit.

Research Question 1b. Do within group differences exist in health services use among the intervention and TAU groups?

Hypothesis 1b. The number of inpatient stays and ED visits of the intervention participants during the six month period after their index enrollment will be significantly lower than their six month pre period claim counts; whereas their post period outpatient visits will be significantly higher.

Hypothesis 1b results: Examination of the kurtosis and skewness statistics for IP, ED, and OP claims counts revealed highly kurtotic and a positive skew distribution across all health service types at pre and post. Further, the Shapiro-Wilk normality tests were significant (p <.001), indicating non-normality (Fields, 2013). Therefore, to test within group differences in the different types of health services, the non-parametric Wilcoxon signed-rank test was applied because it is used to compare two conditions with the same participants in each condition when the outcome data have unusual cases or are in violation of one or more assumptions (Field, 2013). Among the intervention group, the only type of health service with statistically different counts between pre and post periods was outpatient physical health claims. The outpatient claims for physical health services was significantly higher during the six-month period after enrolling in the intervention (*Mdn* = 12) compared to their pre-enrollment period (*Mdn* = 10), *z* =

-2.268, $p = .023$, $r = -.10$, representing a small effect size (Cohen, 1992). Differences in pre and post period claims counts for the other health services types, namely inpatient stays, ED visits, and outpatient behavioral health visits, were not statistically significant (Table 10). Among the TAU group, none of the IP, ED, or OP health service types were significantly different from pre to post (Table 10).

Table 10

Wilcoxon Matched-pair Signed-rank Results by Group: TAU (n=208) and Intervention (n=236)

		Pre-Period		Post Period			
Variable	Group	*Median*	*Range*	*Median*	*Range*	*Z*	*p* value
IP All	TAU	0	0 -27	0	0 - 33	-0.986	0.32
	Interv.	0	0 - 8	0	0 - 12	-1.258	0.21
ED All	TAU	1	0 -19	1	0 - 20	-0.902	0.37
	Interv.	1	0 -14	1	0 - 24	-0.355	0.72
OP BH	TAU	0	0 -244	0	0 - 145	-1.785	0.07
	Interv.	0	0 - 35	0	0 - 43	-0.732	0.46
OP Physical	TAU	16	0 - 233	15	0 - 241	-1.775	0.08
	Interv.*	10	0 - 273	12	0 - 236	-2.268	0.02

*$p < .05$

Note: IP All (all inpatient hospital stays); ED All (all emergency dept. visits);
OP BH (all outpatient/ambulatory care visits for behavioral health services); and
OP Physical (all outpatient/ambulatory care visits for physical/medical services)

Results of Research Question 2

Between Group Differences in Health Services Utilization

Preliminary comparison of predictors and outcomes based on existing diagnosis of depressive disorders (intervention and TAU groups combined)

As noted previously in the Descriptive Analysis section, 100% of the TAU participants had a prior 12-month ICD-9 diagnosis of a depressive disorder, however, less than half (45.8%) of the intervention participants had an actual ICD-9 depression diagnosis. Although both intervention and TAU had either a positive depression diagnosis or depressive symptoms (as assessed from the PHQ-9 tool), it was necessary to determine the extent to which the two groups differed across predictor and outcome variables prior to hypothesis-testing. If the two groups differed based on a documented ICD-9 depressive disorder diagnosis, this would create bias due to this confounding variable. Of the 386 participants (intervention = 178 and TAU = 208) who had data available on whether or not they had a prior ICD-9 depressive diagnosis, 316 (intervention = 108 and TAU = 208) were positively diagnosed with a depressive disorder. The remaining 70 intervention participants did not have a current depression diagnosis. Data on prior 12-month depression ICD 9 diagnosis data were missing for 58 (13.1%) of the total participants.

Pearson chi–square tests revealed that of these 386 patients, those with a positive depression diagnosis compared to those without were more likely to be female (χ^2=10.84, p=.01), in case management (χ^2= 6.52, p=.01); less likely to live in MD (highest primary care physician density); more likely to live in TN (χ^2=10.84, p<.0001); and less likely to have a prior 12-month substance/alcohol use disorder ($\chi^{2=}$ 48.16, p<.0001). Independent samples t-tests revealed no differences between the two groups in age, comorbidity, and illness severity. Table 11 summarizes these findings.

Table 11

Bivariate Analysis of Predictors Comparing Depressive Diagnosis vs. Not Diagnosed (n=386)

	Depressive Diagnosis		No Depressive Diagnosis		Test
Demographics	*n=316*	%	*n=70*	%	Statistic
Gender*					7.86[a]
Female	222	70.3	37	52.9	
Male	94	29.7	33	47.1	
Age in years	*M* =43.07	*SD* =11.77	*M* =45.90	*SD* =11.77	-1.82[b]
18 - 33	75	23.7	14	20.0	
34 - 49	136	43.0	21	30.0	
50 - 69	105	33.2	35	50.0	
Race					2.81[a]
Black/Other	246	77.8	59	84.3	
Caucasian/Asian	65	20.6	8	11.4	
In Case Management					6.52[a]
at index visit*	157	49.7	23	32.9	
Illness Severity (CI3)	*M* =4.21	*SD* =3.99	*M* =4.65	*SD* =4.66	-0.82[b]
Charlson Comorbidity Index	*M* =1.99	*SD* =2.52	*M* =1.81	*SD* =2.28	0.54[b]
0	109	34.5	20	28.6	
1	76	24.1	21	30.0	
2 and higher	131	41.5	29	41.4	
Health Plan**					10.84[a]
Maryland	154	48.7	49	70.0	
Tennessee	135	42.7	16	22.9	
Texas	27	8.5	5	7.1	
Primary Care/BH Provider Density**					10.39[a]
MD (high density)	154	48.7	49	70.0	
TX/TN (low density)	162	51.3	21	30.0	
Existing Substance/Alc. Use Diagnoses **	171	54.1	69	98.6	48.16[a]
Pregnant	21	6.6	6	8.6	0.33[a]

*$p < .05$, **$p < .01$

[a] Pearson chi-square test; [b] *t*-test

Preliminary Outcome Analysis: Health Service Use

Results of the Pearson chi-squares tests used to examine changes from pre to post-enrollment periods in health services use for those with a prior 12-month depression diagnosis compared to those without are provided in Table 12. Patients with a depression diagnosis compared to those without were more likely to increase their outpatient behavioral health visits and decrease their outpatient physical health visits over the two time periods.

As noted previously, depression severity data from the PHQ-9 tool were not available for the TAU group therefore preliminary analysis of the second outcome variable was not conducted.

Table 12

Results of Pearson Chi-square Test Comparing Participants Diagnosed with Depression to No Depression Diagnosis on Change in Health Service Use (n=386)

Health Service Use Change	*n*	*% within diagnosis*	χ^2	*p* value
Inpatient - Increase				
No Depression Dx	10	14.3	0.27	0.60
Depression Dx	38	12.0		
Emergency Dept. - Increase				
No Depression Dx	23	32.9	0.53	0.47
Depression Dx	90	28.5		
Outpatient Beh. Health - Increase**				
No Depression Dx	7	10.0	7.06	<0.01
Depression Dx	77	24.5		
Outpatient Phys. Health - Increase**				
No Depression Dx	43	61.4		
Depression Dx	139	44.3	6.76	<0.01

Note: Behavioral Health and Physical were combined for Inpatient stays and ED visits due to low numbers

*p<.05, **p<.01

Given these differences, a subset of intervention patients with a depression diagnosis during the 12 months prior to the index enrollment date was created to be comparable to the TAU group. Those in the TAU group all had an ICD-9 depressive disorder diagnosis. Propensity score matching using a one to one closest match of propensity scores was again used to identify those patients from the TAU group who were the closest match to those with a positive ICD-9 depressive diagnosis from the intervention group. Covariates used for this second matching process included age, gender, race, state, CI3 (illness severity), case management, SUD/Alcohol use diagnosis, Charlson Comorbidity Index, and pregnancy. Those with a positive pregnancy diagnosis were later excluded from these analyses given the small number (*n*=8), including three from TAU and five from the intervention group because these would affect the inpatient utilization rates during the post-index period. This resulted in a sample of 198 total participants (intervention=99 and TAU=99), all with a positive ICD-9 diagnosis of a depressive disorder during the prior 12 month period.

Pearson chi-squares revealed no statistically significant differences between the new subset of intervention and TAU groups in race, case management, state in which they received services, PC/BH provider density, and gender (Table 13). Independent samples *t*-tests comparing the continuous variables age, CI3 illness severity score, and Charlson Comorbidity index also resulted in no statistically significant differences between the two groups (Table 13). With the exception of an ICD-9 SUD/Alcohol use diagnosis in the 12 months prior to index visit (χ^2=6.14, p <.05), the two groups were comparable across these covariates. However, given the significant decrease in sample size by excluding intervention members with missing or negative ICD-9 depression diagnoses the decision was made to keep these participants in rather than further reducing statistical power.

Table 13

Comparison of Study Participants Diagnosed with Depression, Intervention vs. Treatment as Usual (n=198)

Demographics	Intervention *n=99*	%	TAU *n=99*	%	Test Statistic
Gender					1.93[a]
Female	74	74.7	82	82.8	
Male	25	25.3	17	17.2	
Age in years	*M* =45.72	SD=10.77	*M* =44.44	*SD* =10.02	0.86[b]
18 - 33	14	14.1	16	16.2	
34 - 49	45	45.5	49	49.5	
50 - 69	40	40.4	34	34.3	
Race					0.11[a]
Black/Other	73	73.7	75	75.8	
Caucasian/Asian	26	26.3	24	24.2	
In Case Management at index visit	53	53.5	51	51.5	0.08[a]
Illness Severity (CI3)	*M* =5.28	*SD* =4.30	*M* =4.51	*SD* =4.23	1.26[b]
Charlson Comorbidity Index	*M* =1.90	*SD* =1.87	*M* =1.82	*SD* =2.20	0.28[b]
0	27	27.3	37	37.4	
1	24	24.2	19	19.2	
2 and higher	48	48.5	43	43.4	
Health Plan					2.00[a]
Maryland	35	35.4	43	43.4	
Tennessee	50	50.5	47	47.5	
Texas	14	14.1	9	9.1	
Primary Care/BH Provider Density					1.35[a]
MD (high density)	35	35.4	43	43.4	
TX/TN (low density)	64	64.6	56	56.6	
Existing Substance/Alc. Use Diagnoses*	69	69.7	52	52.5	6.14[a]

*$p < .05$, **$p < .01$

[a] Pearson chi-square test; [b] *t*-test

A series of multivariate logistic regression models were conducted with each type of health service (inpatient, ED, and outpatient) to determine if treatment group is a significant predictor of the odds of having an increase in use of each type of service. All logistic regression models estimating health services use included SUD/Alcohol use diagnosis and pre-period health services use covariates to control for their influence.

Assumptions Testing Multivariate Logistic Regression

The dependent variable for health service utilization is categorical (i.e., increase or no change/decrease) as is depression severity (i.e., increase/no change or decrease) therefore adjustments to the outcome variables were unnecessary. Because the majority of the study's analyses involved testing multivariate logistic regression models, checks of multivariate logistic regression assumptions were conducted prior to beginning analyses.

Linearity of the logit. This assumption is based on the linear relationship between any continuous covariates and the logit of the outcome variables. The Box Tidwell test was used to examine these relationships. In the logistic regression models that focused on treatment group predicting likelihood of increasing health service utilization, the continuous covariates were age, CI3 (illness severity score), Charlson Comorbidity Index, number of pre period outpatient physical health visits, and number of outpatient behavioral health visits. In the logistic regression models focused on applying the BMVP to the change in health service use and depression severity, the continuous variables were age, CI3 (illness severity score), Charlson Comorbidity Index, number of pre period outpatient physical health visits, and number of outpatient behavioral health visits, initial PHQ-9 depression severity score, and number of behavioral health coach contacts. The Box Tidwell test required transforming continuous variables into their natural log and then creating an interaction term with the original continuous

variable and also interactions with the dependent variables. All interactions were non-significant except for the interaction of the natural log of pre outpatient physical visits and the dependent variable change in outpatient physical visits ($p < .05$). Because violation of this assumption usually results in a Type II error, resulting in a more conservative approach in identifying significant relationships, this violation was accepted.

Multicollinearity. The assumption of multicollinearity was tested for among the model predictors prior to inclusion in the multivariate logistic regression models. The Tolerance and variance inflation factors (VIF) between the predictors were reviewed. All VIF values were within an acceptable range (tolerance values were greater than 0.1 and VIF values were less than 10) indicating multicollinearity was not a concern (Field, 2013).

Independence of Errors. This is tested by calculating the dispersion parameter, or the ratio of the chi-square goodness of fit statistic to its degrees of freedom, which should be less than 1.0, otherwise overdispersion is a problem (Field, 2013). The data met the assumption of independent errors (Durbin-Watson = 1.93).

Research Question 2a: Are Medicaid participants of the intervention program less likely to increase their inpatient stays and ED visits, and more likely to increase their outpatient visits from pre to post periods, compared to members receiving usual care for depressive disorders?

Hypothesis 2a. After controlling for confounders, intervention participants will be less likely to increase their inpatient stays and ED visits, and more likely to increase their outpatient visits between pre and post index dates compared to participants receiving usual care for diagnosed depressive disorders.

Hypothesis 2a results.

Group status (Collaborative Care for depression or TAU) was not a significant predictor of the odds in increasing health services use from pre to post index date, after controlling for prior health service use and an existing SUD/alcohol use diagnosis (Table 14).

Table 14

Summary of Intervention vs. TAU Estimating Odds of Increased Health Services Use

	Change in Health Service Use from Pre to Post-Enrollment Periods[1]							
	IP (BH/PHYS)		ED (BH/PHYS)		OP BH		OP PHYS	
Variable	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1								
Pre-enrollment service Use[2]	2.40	[0.93, 6.21]	0.78	[0.42, 1.47]	0.99	[0.95, 1.03]	0.99*	[0.97,1.00]
SUD/Alcohol dx	0.85	[0.35, 2.07]	1.54	[0.79, 3.00]	0.76	[0.40, 1.45]	0.75	[0.41, 1.38]
Model 2								
Treatment Type	0.94	[0.39, 2.28]	0.93	[0.50, 1.74]	1.56	[0.83, 2.96]	0.84	[0.46, 1.51]
Hosmer and Lemeshow Test *p*-value	0.78		0.86		0.16		0.72	
Nagelkerke R^2	0.03	$\Delta R^2 = .00$	0.01	$\Delta R^2 = .00$	0.02	$\Delta R^2 = .01$	0.09	$\Delta R^2 = .00$
n	198		198		198		198	

*$p \leq .05$, **$p \leq .01$

[1]Binary outcome variable: 0 = decrease/no change; 1= increase

[2]Pre-enrollment service use defined as 0=none, 1=1 or more for IP and ED; continuous variables for OP BH & OP PHYS visits

Research Question 2b. Is the interaction between intervention and TAU group and level of comorbidity a significant predictor of health service use during the post-enrollment period?

Hypothesis 2b. After controlling for confounders, the interaction between the two groups and level of comorbidity is a significant predictor of health service use during the six month period after index enrollment date.

Hypothesis 2b results.

The role of comorbidity is an important one to examine given the expanding literature in health services research on chronic physical conditions and comorbid depression. In the current study, comorbidity was assessed using the Charlson Comorbidity Index, which is derived from 17 ICD-9 or 10 codes of common chronic medical conditions and weighted by increasing age. Within this sample, diabetes (both without and with complications) and chronic pulmonary disease were the largest chronic illness categories (38.9% and 26.3%, respectively.). Given the low occurrence of inpatient and ED events within the current study, these outcome variables were coded as 0 = none and 1 = one or more encounters during the six-month post-enrollment period. Outpatient visits were coded as 0 = maintain or decrease and 1 = increase in visits.

Analysis of the sub-sample of 198 intervention and TAU participants diagnosed with a depressive disorder found that the interaction between group status and comorbidity did not predict the likelihood of an increase in inpatient, ED, or outpatient health visits (Tables 15- 17). Main effects were found in the outpatient visits. Those in the intervention were 2.5 times more likely to increase their outpatient BH visits, *OR* = 2.48, *95% CI* [1.04, 5.91]. As *comorbidity*

scores increased, the odds of patients increasing their outpatient physical health visits increased 32%, OR=1.32, *95% CI* [0.57,1.06] (Table 17).

Table 15

Summary of Comorbidity X Treatment Interaction Predicting ≥ 1 Inpatient Stays During Post Period (n=198)

Variable	OR	*95% CI*	*p* value
Model 1			
Pre Inpatient Stays[1]**	18.75	[7.43, 47.33]	.00
SUD/Alcohol Use Diagnosis	0.55	[.23, 1.34]	.19
Model 2			
Treatment Type	0.96	[.27, 3.38]	.95
Charlson Comorbidity[2]	1.25	[.97, 1.62]	.09
Model 3			
Comorbidity X Treatment	1.01	[.68, 1.51]	.95
Hosmer and Lemeshow Test *p*-value	0.37		
Nagelkerke R^2	0.42	ΔR^2 = .03	

*$p < .05$, ** $p < .01$

[1]Pre Inpatient Stays defined as 0= None, 1= 1 or more admissions
[2]Comorbidity Score based on Age-weighted Charlson Comorbidity Index

Table 16

Summary of Comorbidity X Treatment Interaction Predicting ≥ 1 Emergency Dept. Visits (Beh. Or Phys.) During Post Period (n=198)

Variable	OR	*95% CI*	*p* value
Model 1			
Pre ED Visits[1]**	4.86	[2.58, 9.16]	.00
SUD/Alcohol Use Diagnosis	1.46	[.77, 2.77]	.25
Model 2			
Treatment Type	0.78	[.33, 1.82]	.57
Charlson Comorbidity[2]	1.03	[.84, 1.23]	.80
Model 3			
Comorbidity X Treatment	1.09	[.80, 1.49]	.59
Hosmer and Lemeshow Test *p*-value	0.94		
Nagelkerke R^2	0.20	ΔR^2 =	.10

*$p < .05$, ** $p < .01$

[1]Pre Emerg. Dept.visit defined as 0= None, 1= 1 or more visits

[2]Comorbidity Score based on Age-weighted Charlson Comorbidity Index

Table 17

Summary of Comorbidity X Treatment Interaction Predicting Increase in Outpatient Visits During Post Period (n=198)

Variable	OR	*95% CI*	*p* value
Outpatient Behavioral Health Visits			
Model 1			
Pre OP BH Visits[1]	0.99	[.95, 1.03]	.46
SUD/Alcohol Use Diagnosis	0.73	[.38, 1.40]	.34
Model 2			
Treatment Type*	2.48	[1.04, 5.91]	.04
Charlson Comorbidity[2]	1.16	[.95, 1.41]	.15
Model 3			
Comorbidity X Treatment	0.79	[.58, 1.06]	.12
Hosmer and Lemeshow Test *p*-value	0.79		
Nagelkerke R^2	0.04	$\Delta R^2 =$ .03	
Outpatient Physical Health Visits			
Model 1			
Pre OP PHYS Visits[1]**	0.97	[.96, .99]	.00
SUD/Alcohol Use Diagnosis	0.69	[.37, 1.26]	.24
Model 2			
Treatment Type	1.21	[.54, 2.68]	.65
Charlson Comorbidity[2]*	1.32	[1.05, 1.67]	.02
Model 3			
Comorbidity X Treatment	0.78	[.57, 1.06]	.12
Hosmer and Lemeshow Test *p*-value	0.16		
Nagelkerke R^2	0.12	$\Delta R^2 =$ .03	

*$p < .05$, ** $p < .01$

[1]Pre Outpatient (BH & PHYS) included in model as continous variable

[2]Comorbidity Score based on Age-weighted Charlson Comorbidity Index

Note: Outcome for outpatient visits defined as 0 = no change/decrease, 1 = increase

Results of Research Question 3

The Behavioral Model of Vulnerable Populations was utilized to identify possible predictors of health service use and depression scores from the available individual and environmental level data. There were 15 potential predictors available to include in the models, including the pre period use of services, however given the limited sample size (n=236), model overestimation was a concern (Field, 2013). It is also important to build model parsimony. To identify the most salient predictors with the intervention-only sample, associations between the predictor variables identified through the BMVP model and each health service type as well as depression severity outcome variable were analyzed using independent samples *t*-tests for continuous variables and the phi chi square test statistic for nominal binary categorical variables. The phi coefficient is the appropriate statistic to use with dichotomous variables (Tabachnik & Fidell, 2001). The following variables were statistically significant at the alpha level $p < .10$ for one or more of the outcome variables, resulting in twelve predictors that were included in the multivariate logistic regression models. Vittinghoff & McCulloch (2007) provide empirical support for including less than ten events per predictor in logistic and cox regressions. Events in this study were defined as participants. Tables 18 through 26 provide the results of the phi chi square tests and independent samples *t*-tests for the original 15 variables and their association with a a) decrease/no change in health services use or b) decrease in depression severity.

Figure 4 was adapted from the version listed earlier to list the 12 predictors from the bivariate analyses that met the alpha level ($p < .10$). These were included in the multivariate logistic regression models used to address research question 3.

Figure 4. Application of the Behavioral Model for Vulnerable Populations (Adapted) for Analysis of Intervention-only Participants

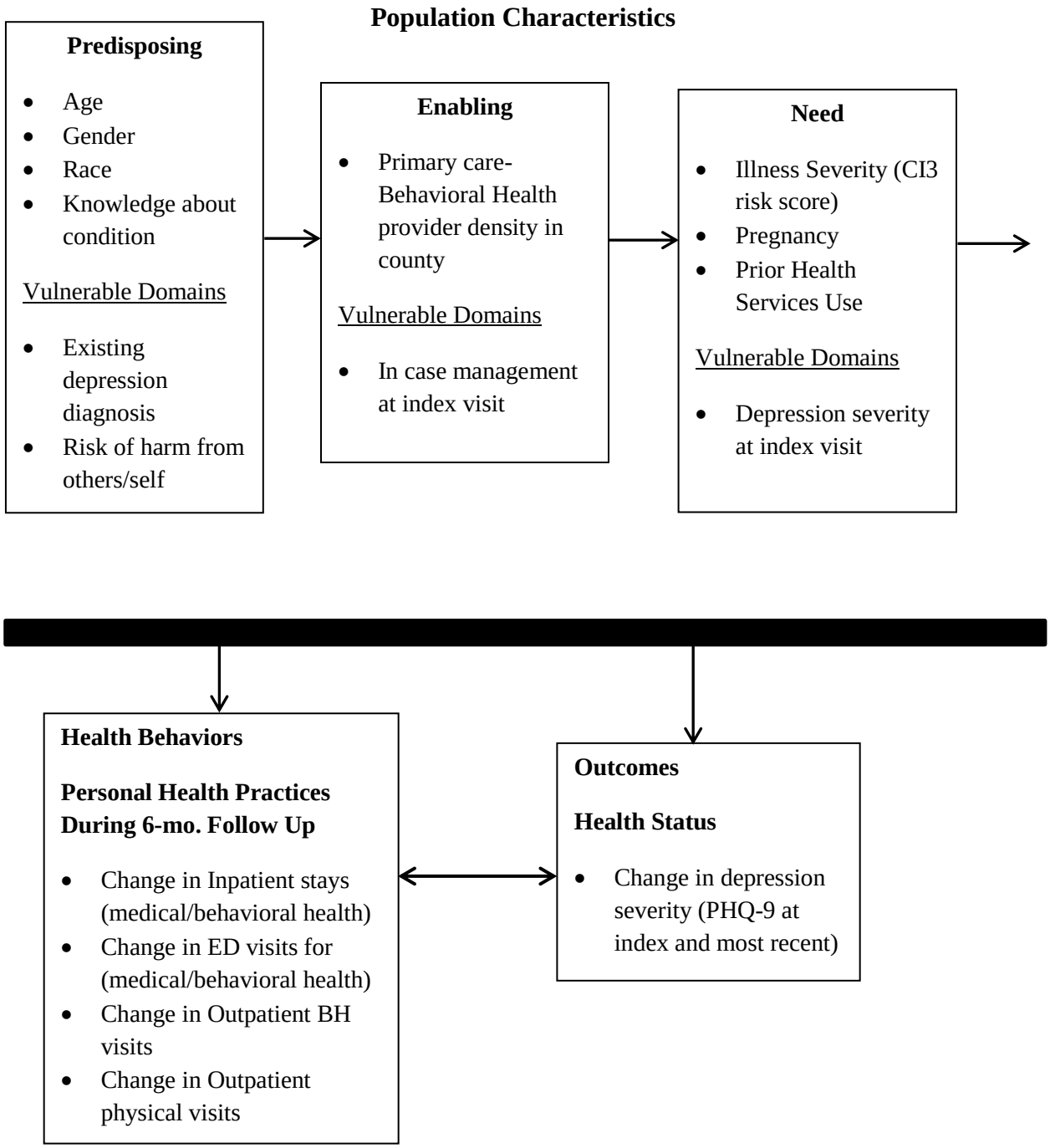


Table 18

Summary of Phi Chi Square Tests to Identify Most Salient Predictors of a Decrease/No Change in Depression Severity (n=236)

Depression Severity Decrease	*n*	*% within predictor*	*Φ*	*p* value
Gender (*n*=236)				
Male	36	48.00	-0.04	0.516
Female	70	43.50		
Race (*n*=224)				
Black/Other	85	47.00	-0.04	0.546
Caucasian/Asian Pacific Islander	18	41.90		
Pregnant at Index Visit (*n*=236)				
No	97	45.30	-0.03	0.692
Yes	9	40.90		
Case Management (*n*=236)				
No	61	45.50	-0.01	0.830
Yes	45	44.10		
Existing Depression Diagnosis* (*n*=178)				
No	35	50.00	-0.11	0.144
Yes	42	38.90		
Existing Substance Use/Alc. Diagnosis (*n*=236)				
No	43	47.80	-0.05	0.488
Yes	63	43.20		
Prim. Care-Beh. Health Prov. Density (*n*=235)***				
Low (TN/TX)	39	35.10	0.19	0.004
High (MD)	67	53.60		
Knowledge of Condition (Index Visit) (*n*=235)				
Have enough	22	50.00	-0.049	0.452
Open to more	84	43.80		
Risk of harm to self/others* (*n*=235)				
No	74	41.60	0.12	0.07
Yes	32	55.20		

Note: Depression severity coded as 0 = no change/increase; 1 = decrease between index and last contact
*p<.15,**p<.05, ***p<.01

Table 19

Summary of Phi Chi Square Tests to Identify Most Salient Predictors of a Decrease/No Change in Inpatient Stays (n=236)

Inpatient Stays - Decrease/No Change	*n*	*% within predictor*	*Φ*	*p* value
Gender (*n*=236)				
Male	69	92.00	-0.08	0.210
Female	139	86.30		
Race (*n*=224)				
Black/Other	161	89.00	-0.06	0.344
Caucasian/Asian Pacific Islander	36	83.70		
Pregnant at Index Visit (*n*=236)***				
No	195	91.10	-0.29	0.000
Yes	13	59.10		
Case Management (*n*=236)				
No	120	89.60	-0.05	0.440
Yes	88	86.30		
Existing Depression Diagnosis (*n*=178)				
No	60	85.70	0.01	0.94
Yes	93	86.10		
Existing Substance Use/Alc. Diagnosis* (*n*=236)				
No	83	92.20	-0.10	0.13
Yes	125	85.60		
Prim. Care-Beh. Health Prov. Density* (*n*=236)				
Low (TN/TX)	94	84.70	0.10	0.12
High (MD)	114	91.20		
Knowledge of Condition (Index Visit) (*n*=236)				
Have enough	38	86.40	0.03	0.69
Open to more	170	88.50		
Risk of harm to self/others (*n*=236)				
No	155	87.10	0.06	0.38
Yes	53	91.40		

Note: Inpatient stays for BH and physical combined due to low counts. Coded as 0 = increase; 1 = no change/decrease
*p<.15,**p<.05, ***p<.01

Table 20

Summary of Phi Chi Square Tests to Identify Most Salient Predictors of a Decrease/No Change in ED Visits (n=236)

ED Visits - Decrease/No Change	*n*	*% within predictor*	*Φ*	*p* value
Gender (*n*=236)				
Male	53	70.70	-0.01	0.864
Female	112	69.60		
Race (*n*=224)				
Black/Other	128	70.70	-0.05	0.473
Caucasian/Asian Pacific Islander	28	65.10		
Pregnant at Index Visit (*n*=236)				
No	149	69.60	0.02	0.763
Yes	16	72.70		
Case Management (*n*=236)				
No	97	72.40	-0.06	0.342
Yes	68	66.70		
Existing Depression Diagnosis (*n*=178)				
No	47	67.10	0.04	0.34
Yes	77	71.30		
Existing Substance Use/Alc. Diagnosis (*n*=236)				
No	66	73.30	-0.06	0.37
Yes	99	67.80		
Prim. Care-Beh. Health Prov. Density (*n*=236)				
Low (TN/TX)	77	69.40	0.01	0.86
High (MD)	88	70.40		
Knowledge of Condition (Index Visit) (*n*=236)				
Have enough	32	72.70	-0.03	0.65
Open to more	133	69.30		
Risk of harm to self/others (*n*=236)				
No	123	69.10	0.03	0.63
Yes	42	72.40		

Note: Inpatient stays for BH and physical combined due to low counts. Coded as 0 = increase; 1 = no change/decrease
*p<.15,**p<.05, ***p<.01

Table 21

Summary of Phi Chi Square Tests to Identify Most Salient Predictors of a Decrease/No Change in Outpatient Behavioral Health Visits (n=236)

Outpatient BH visits- Decrease/No Change	*n*	*% within predictor*	*Φ*	*p* value
Gender (*n*=235)**				
Male	67	89.30	-0.148	0.02
Female	123	76.90		
Race (*n*=223)*				
Black/Other	149	82.80	-0.129	0.05
Caucasian/Asian Pacific Islander	30	69.80		
Pregnant at Index Visit (*n*=235)*				
No	169	79.30	0.119	0.07
Yes	21	95.50		
Case Management (*n*=235)				
No	107	79.90	0.029	0.65
Yes	83	82.20		
Existing Depression Diagnosis (*n*=177)**				
No	63	90.00	-0.270	0.00
Yes	71	66.40		
Existing Substance Use/Alc. Diagnosis (*n*=235)				
No	76	84.40	-0.072	0.27
Yes	114	78.60		
Prim. Care-Beh. Health Prov. Density (*n*=235)***				
Low (TN/TX)	70	63.60	0.410	0.00
High (MD)	120	96.00		
Knowledge of Condition (Index Visit) (*n*=235)***				
Have enough	27	62.80	0.217	0.001
Open to more	163	84.90		
Risk of harm to self/others (*n*=235)**				
No	137	77.40	0.15	0.02
Yes	53	91.40		

Note: Outpatient visits for BH services coded as 0 = increase; 1 = no change/decrease

*p<.15,**p<.05, ***p<.01

Table 22

Summary of Phi Chi Square Tests to Identify Most Salient Predictors of a Decrease/No Change in Outpatient Physical Health Visits (n=236)

Outpatient Phys. visits- Decrease/No Change	*n*	*% within predictor*	*Φ*	*p* value
Gender (*n*=235)*				
Male	36	48.00	-0.02	0.80
Female	74	46.30		
Race (*n*=223)				
Black/Other	86	47.80	-0.01	0.88
Caucasian/Asian Pacific Islander	20	46.50		
Pregnant at Index Visit (*n*=235)				
No	102	47.90	-0.07	0.30
Yes	8	36.40		
Case Management (*n*=235)**				
No	53	39.60	0.17	0.01
Yes	57	56.40		
Existing Depression Diagnosis (*n*=177)*				
No	27	38.60	0.14	0.06
Yes	57	53.30		
Existing Substance Use/Alc. Diagnosis (*n*=235)				
No	43	47.80	-0.02	0.82
Yes	67	46.20		
Prim. Care-Beh. Health Prov. Density (*n*=235)				
Low (TN/TX)	52	47.30	-0.01	0.89
High (MD)	58	52.70		
Knowledge of Condition (Index Visit) (*n*=235)				
Have enough	20	46.50	0.003	0.97
Open to more	90	46.90		
Risk of harm to self/others (*n*=235)				
No	80	45.20	0.06	0.39
Yes	30	51.70		

Note: Outpatient visits for BH services coded as 0 = increase; 1 = no change/decrease

*p<.15,**p<.05, ***p<.01

Table 23

Independent Group T-Test Between Inpatient Stays Change and Continuous Predictors

	Decrease/Maintain		Increase		
	M	*SD*	*M*	*SD*	*t*-test
Age (*n*=236)	43.47	12.19	40.67	13.85	-1.13
Charlson Comorbidity Score (*n*=236)	1.52	1.98	1.82	1.79	.76
CI3(illness severity) (*n*=236)	4.00	4.09	5.45	4.07	-1.78
Depression Severity Initial (*n*=236)	15.35	4.11	14.96	4.13	-.46
Confidence to Take Action (*n*=231)	7.47	2.37	7.21	2.13	-.54
Importance of Condition (*n*=230)	7.92	2.20	7.43	2.19	-1.11

*$p<.15$, **$p < .05$, ***$p < .01$

Table 24

Independent Group T-Test Between ED Visits Change and Continuous Predictors

	Decrease/Maintain		Increase		
	M	*SD*	*M*	*SD*	*t*-test
Age (*n*=236)*	44.15	12.64	40.78	11.59	-1.93
Charlson Comorbidity Score (*n*=236)	1.62	2.01	1.41	1.83	-.78
CI3(illness severity) (*n*=236)	4.19	4.14	4.12	4.06	.11
Depression Severity Initial (*n*=236)	15.16	4.04	15.62	4.27	.78
Confidence to Take Action (*n*=231)	7.46	2.22	7.39	2.60	-.22
Importance of Condition (*n*=230)	7.88	2.19	7.83	2.23	-.15

*$p<.15$, **$p < .05$, ***$p < .01$

Table 25

Independent Group T-Test Between Outpatient Visits Change and Continuous Predictors

	Decrease/Maintain		Increase		
	M	*SD*	*M*	*SD*	*t*-test
Outpatient Behavioral Health					
Age (*n*=235)**	42.26	12.54	46.40	11.14	2.03
Charlson Comorbidity Score (*n*=235)	1.55	2.02	1.49	1.56	-.20
CI3(illness severity) (*n*=235)	4.02	4.13	4.42	3.27	-.60
Depression Severity Initial (*n*=235)*	15.07	4.06	16.31	4.24	1.83
Confidence to Take Action (*n*=230)	7.49	2.39	7.18	2.10	-.81
Importance of Condition (*n*=229)	7.84	2.26	7.91	1.93	.19
Outpatient Physical Health					
Age (*n*=235)	42.92	12.14	43.18	1.26	.16
Charlson Comorbidity Score (*n*=235)	1.54	1.83	1.54	2.03	.03
CI3(illness severity) (*n*=235)*	4.52	4.16	3.73	3.79	1.53
Depression Severity Initial (*n*=235)	4.09	15.37	15.25	4.15	-.23
Confidence to Take Action (*n*=230)	7.36	2.33	7.49	2.36	.40
Importance of Condition (*n*=229)	7.76	1.98	7.93	2.38	.56

**p<.15, **p* < .05, ****p* < .01

Table 26

Independent Group T-Test Depression Severity Change and Continuous Predictors

	Increase/Maintain		Decrease		
	M	*SD*	*M*	*SD*	*t*-test
Age (*n*=236)	43.03	12.10	43.26	12.82	-.14
Charlson Comorbidity Score (*n*=236)	1.56	1.98	1.56	1.93	.02
CI3(illness severity) (*n*=236)	4.37	3.96	3.93	4.29	.82
Depression Severity Initial (*n*=236)*	14.91	4.04	15.78	4.16	-1.63
Confidence to Take Action (*n*=231)	7.58	2.22	7.23	2.47	1.00
Importance of Condition (*n*=230)	7.74	2.21	8.01	2.18	-.93

**p<.15, **p* < .05, ****p* < .01

Research Question 3a. Using the Behavioral Model of Vulnerable Populations (BMVP) as a framework, what are the significant predictors of health service use among the intervention participants during the six months of follow up?

Hypothesis 3a. Among the intervention participants, a significant association exists between predisposing, enabling, and need characteristics and change in health services use between the six-month pre and post index periods.

Hypothesis 3a results.

Multivariate logistic regressions were conducted using the identified11 predictors plus pre-index visit health service use, to determine if the model predicted change in use of each of the health service types and depression severity. Although there were initially 236 intervention participants in the data set, due to missing data in the variables 12-month prior depression diagnosis and race (missing n = 58 [24.6%]; n = 12 [5.1%] , respectively), the multivariate logistic regression analyses were limited to 171 participants. Having prior or current case management services, which is an enabling factor, was a consistent predictor of likelihood to maintain or decrease service use. Regarding inpatient stays, patients who were pregnant had a 94% higher likelihood of increasing their inpatient stays compared to those who are not pregnant, OR=.06 , 95% CI [.01, .32] (Table 27). Patients with higher CI3 illness severity scores had a12% higher likelihood of increasing their inpatient stays during the six-month follow up compared to those with lower scores, OR= .88, 95% CI [.78, 1.00]. Regarding ED visits, patients with prior ED visits during the prior six months were 3.2 times more likely to decrease or maintain their ED visits during the follow up period, OR=3.19, 95% CI [1.40, 7.29] (Table 28). Patients in case management were 3.2 times more likely to increase their ED visits compared to those not in case management, OR=.32, 95% CI [.14, .73] (Table 28). As age increases by one year, there was a 5% increase in likelihood of decreasing/maintaining ED visits, OR=1.05, 95% CI [1.01, 1.09]. Regarding outpatient behavioral health visits, patients in case management at index visit were 3.5 times more likely to decrease/maintain their behavioral

health visits, OR=3.50, 95% CI [1.31, 9.34] (Table 29). Those in the higher provider density sites (Baltimore, MD) were nearly 12 times more likely to decrease or maintain their behavioral health visits compared to those in the less provider-dense health plans (TX and TN), OR=11.88, 95% CI [3.24, 43.61]. Regarding outpatient physical health visits, patients in case management at index visit were 2.2 times more likely to decrease or maintain their outpatient physical health visits compared to those who were not in case management, OR=2.21, 95% CI [1.08, 4.51] (Table 30).

The type of population characteristic from the BVMP that each significant predictor represents is listed below in bold by type of health service use:

- Inpatient (BH and PHYS) usage –pregnancy (**NEED**), CI3 illness severity (**NEED**)
- ED (BH and PHYS) usage –age (**PREDISPOSING**), case management (**ENABLING**), prior ED visits (**NEED**)
- Outpatient behavioral health usage –case management (**ENABLING**), primary care-behavioral health physician density (**ENABLING**)
- Outpatient physical health usage – case management (**ENABLING**), prior visits **(NEED)**

Each of the three factors (i.e., predisposing, enabling, and need) had at least one variable predicting health service use, providing support for the BMVP model. The most prevalent types of the BMVP's population characteristics predicting health service use were enabling and need characteristics.

Table 27

Summary of Logistic Regression Model Estimating Odds of Decrease/Maintain in Inpatient Stays Between Pre and Post Periods (n=171)

Variable	*OR*	*95% CI*	*p* value
Pre Inpatient Stays (None or ≥ 1)	1.412	[0.357, 5.587]	.623
Gender (Female)	0.716	[0.218, 2.350	.582
Age	1.010	[.962, 1.060]	.702
Race (Black/Other)	1.237	[.364, 4.207]	.733
Pregnancy (No)**	0.055	[0.009, .320]	.001
Depression Severity Initial	1.019	[0.901, 1.152]	.767
CI3 (Illness Severity)*	0.883	[0.782, .997]	.045
Case Management (No)	1.408	[.484, 4.098]	.530
Existing Dep. Diagnosis (No)	1.265	[0.441, 3.634]	.662
Knowledge of Condition (Has enough)	0.464	[0.126, 1.711]	.249
Risk of Harm/Self-harm (No)	0.843	[0.211, 3.361]	.808
Prim. Care-Beh. Health Prov. Density (Low)	3.443	[0.905, 13.102]	.070
Hosmer and Lemeshow Test *p*-value	.59		
Nagelkerke R^2	.19		

*$p < .05$, ** $p < .01$
Note1. Binary outcome variable: 0 = increase; 1= decrease/maintain
Note2. Reference groups are listed in parentheses

Table 28

Summary of Logistic Regression Model Estimating Odds of Decrease/Maintain in Emergency Dept. Visits Between Pre and Post Periods (n=171)

Variable	*OR*	*95% CI*	*p* value
Pre ED Visits (None or $\geq$ 1)**	3.193	[1.398, 7.294]	.006
Gender (Female)	.794	[0.346, 1.825]	.587
Age*	1.048	[1.011, 1.086]	.010
Race (Black/Other)	.851	[.339, 2.137]	.731
Pregnancy (No)	2.082	[0.425, 10.190]	.365
Depression Severity Initial	0.973	[0.891, 1.064]	.550
CI3 (Illness Severity)	0.983	[0.898, 1.075]	.703
Case Management (No)**	.315	[.135, .731]	.007
Existing Dep. Diagnosis (No)	1.485	[0.681, 3.241]	.321
Knowledge of Condition (Have enough)	0.823	[0.324, 2.091]	.682
Risk of Harm/Self-harm (No)	0.803	[0.318, 2.026]	.642
Prim. Care-Beh. Health Prov. Density (Low)	1.195	[0.465, 3.070]	.711
Hosmer and Lemeshow Test *p*-value	.15		
Nagelkerke R^2	.15		

*$p < .05$, ** $p < .01$

Note1. Binary outcome variable: 0 = increase; 1= decrease/no change

Note2. Reference groups are listed in parentheses

Table 29

Summary of Logistic Regression Model Estimating Odds of Decrease/Maintain in Outpatient Behavioral Health Visits During Post Period (n=170)

Variable	*OR*	*95% CI*	*p* value
Number of Outpatient BH Visits Pre Period	1.01	[0.94, 1.09]	.78
Gender (Female)	1.44	[0.495, 4.17]	.51
Age	.97	[.925, 1.01]	.11
Race (Black/Other)	1.27	[.474, 3.40]	.64
Pregnancy (No)	1.71	[0.162, 18.09]	.66
Depression Severity Initial	0.92	[0.825, 1.02]	.10
CI3 (Illness Severity)	1.005	[0.893, 1.13]	.94
Case Management (No)*	3.50	[1.309, 9.34]	.01
Existing Dep. Diagnosis (No)	0.36	[0.126, 1.01]	.05
Knowledge of Condition (Have enough)	0.97	[0.355, 2.62]	.95
Risk of Harm/Self-harm (No)	1.88	[0.523, 6.73]	.33
Prim. Care-Beh. Health Prov. Density (Low)**	11.88	[3.238, 43.61]	.00
Hosmer and Lemeshow Test *p*-value	.55		
Nagelkerke R^2	.39		

*$p < .05$, ** $p < .01$

Note1. Binary outcome variable: 0 = increase; 1= decrease/no change

Note2. Reference groups are listed in parentheses

Table 30

Summary of Logistic Regression Model Estimating Odds of Decrease/Maintain in Outpatient Physical Health Visits During Post Period (n=170)

Variable	*OR*	*95% CI*		*p* value
Number of Outpatient PHY Visits Pre Period*	1.03	[1.00,	1.06]	.028
Gender (Female)	1.37	[0.63,	2.98]	.434
Age	.99	[.96,	1.03]	.395
Race (Black/Other)	1.31	[.56,	3.06]	.531
Pregnancy (No)	.65	[0.15,	2.82]	.568
Depression Severity Initial	.98	[0.90,	1.06]	.647
CI3 (Illness Severity)	.98	[0.89,	1.07]	.604
Case Management (No)*	2.21	[1.08,	4.55]	.031
Existing Dep. Diagnosis (No)	1.46	[0.71,	3.00]	.300
Knowledge of Condition (Have enough)	.75	[0.32,	1.77]	.503
Risk of Harm/Self-harm (No)	1.07	[0.46,	2.46]	.871
Prim. Care-Beh. Health Prov. Density (Low)	1.37	[0.58,	3.26]	.479
Hosmer and Lemeshow Test *p*-value	.23			
Nagelkerke R^2	.13			

*$p < .05$, ** $p < .01$

Note1. Binary outcome variable: 0 = increase; 1= decrease/no change

Note2. Reference groups are listed in parentheses

Research Question 3b. Using the BMVP as a framework, what are the significant predictors of decreased depression among the intervention participants during the six months of follow up?

Hypothesis 3b. Among the program participants, a significant association exists between predisposing, enabling, and need characteristics and change in depression severity scores between the six-month pre and post periods after enrollment in the collaborative care program.

Hypothesis 3b results.

The eleven selected predictors representing the predisposing, enabling, and need population characteristics of the BMVP were included in the multivariate logistic regression model to predict change in depression severity. Knowledge of condition (predisposing predictor) and provider density (enabling

predictor) were significant predictors of change in depression severity. Patients who felt they had enough knowledge at index visit were 2.8 times more likely to have a decrease in their depression severity compared to those who felt they did not have enough knowledge, OR= 0.36, 95% CI [.15, .88] (Table 31). Patients in the Maryland health plan were 3.4 times more likely to decrease their depression severity scores compared to TN and TX, which had lower provider densities compared to MD, OR=3.37, 95% CI [1.36, 8.37] (Table 31).

Table 31

Summary of Logistic Regression Model Estimating Odds of a Decrease in Depression Severity Between Pre and Post Period (n=171)

Variable	*OR*	*95% CI*	*p* value
Depression Severity Initial	1.082	[0.996, 1.176]	.061
Gender (Female)	.518	[0.231, 1.161]	.110
Age	1.014	[.981, 1.048]	.418
Race (Black/Other)	.990	[.414, 2.370]	.982
Pregnancy (No)	1.207	[0.267, 5.450]	.807
CI3 (Illness Severity)	0.988	[0.911, 1.073]	.780
Case Management (No)	.729	[.350, 1.518]	.399
Existing Dep. Diagnosis (No)	0.667	[0.325, 1.369]	.270
Knowledge of Condition (Have enough)*	0.359	[0.147, .878]	.025
Risk of Harm/Self-harm (No)	1.358	[0.597, 3.090]	.465
Prim. Care-Beh. Health Prov. Density (Low)**	3.367	[1.355, 8.367]	.009
Hosmer and Lemeshow Test *p*-value	.59		
Nagelkerke R^2	.17		

*$p < .05$, ** $p < .01$
Note1. Binary outcome variable: 0 = increase/maintain; 1= decrease
Note2. Reference groups are listed in parentheses

Research Question 3c. Among the intervention participants, does a significant association exist between the change in depression severity and change in health services used during follow up?

Hypothesis 3c. Among the intervention participants, a significant association exists between the change in depression severity and change in inpatient stays, ED visits, and outpatient visits from pre to post enrollment date, after controlling for confounders.

Hypothesis 3c results.

The framework of the BMVP also depicts an association between health behaviors (i.e., health services use) and health outcomes (i.e., depression severity) after taking into account the variance accounted for by the social determinants of health (i.e., predisposing, enabling, and need). Preliminary bivariate analysis of the change from pre to post in each type of health service use and depression severity using independent samples *t*-tests revealed a statistically significant relationship between inpatient stays and change in depression severity ($t(46.71) = -2.245$, $p < .05$, Mean difference -1.483, 95% CI [-2.81, -.15]. Participants whose inpatient stays decreased or maintained had a significant decrease in their depression scores compared to those whose stays increased. Associations between the amount of change in depression severity and ED, outpatient behavioral health, and outpatient physical health visits were not statistically significant. However, after controlling for the variance contributed by the BMVP's population characteristics, the hierarchical multivariate logistic regression models revealed no significant relation exists between the change in health services use and change in depression severity (Table 32).

Table 32

Summary of Hierarchical Multiple Logistic Regression Analyses of Change in Depression Severity Estimating Odds of Decreasing/Maintaining Health Services Use

	Change in Health Service Use from Pre to Post-Enrollment Periods[1]							
	IP (BH/PHYS)		ED (BH/PHYS)		OP BH		OP PHYS	
Variable	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1								
Pre-enrollment Service Use[2]	1.346	[0.34, 5.33]	3.14**	[1.39, 7.12]	1.02	[0.94, 1.10]	1.03*	[1.00, 1.06]
Gender (Female)	0.82	[0.25, 2.72]	0.81	[0.35, 1.87]	1.57	[0.55, 4.52]	1.43	[0.65, 3.13]
Age	1.01	[0.96, 1.06]	1.05**	[1.01, 1.09]	0.97	[0.93, 1.01]	0.99	[0.96, 1.02]
Race (Black/Other)	0.79	[0.23, 2.74]	0.83	[0.33, 2.07]	1.24	[0.47, 3.30]	1.30	[0.55, 3.04]
Pregnancy (No)	0.05**	[0.01, 0.30]	2.07	[0.42, 10.26]	1.95	[0.19, 20.52]	0.64	[0.15, 2.75]
CI3 (Illness Severity)	0.89	[0.78, 1.01]	0.99	[0.90, 1.08]	1.01	[0.90, 1.14]	0.98	[0.89, 1.08]
Case Management (No)	1.50	[0.50, 4.46]	0.313**	[0.14, 0.73]	3.09*	[1.20, 7.97]	2.22*	[1.07, 4.58]
Existing Dep. Diagnosis (No)	1.29	[0.45, 3.72]	1.45	[0.67, 3.15]	0.31*	[0.11, 0.86]	1.46	[0.72, 3.00]
Knowledge of Condition (Have enough)	0.52	[0.14, 1.90]	0.84	[0.33, 2.134]	1.00	[0.37, 2.71]	0.77	[0.33, 1.84]
Risk of Harm/Self-harm (No)	0.73	[0.19, 2.76]	0.71	[0.291, 1.71]	1.54	[0.43, 5.52]	0.92	[0.41, 2.08]
PC-BH Provider Density (Low)	3.14	[0.82, 12.11]	1.20	[0.47, 3.05]	11.22**	[3.21, 39.18]	1.38	[0.58, 3.28]
Model 2								
Depression Change[3]	1.09	[0.97, 1.23]	1.02	[0.95, 1.11]	1.02	[0.93, 1.12]	1.05	[.98, 1.13]
Hosmer and Lemeshow Test p value	0.32		0.20		0.51		0.02	
Nagelkerke R^2	0.21	$\Delta R^2 = .03$	0.15	$\Delta R^2 = .00$	0.38	$\Delta R^2 = .00$	0.15	$\Delta R^2 = .02$
n	171		171		170		170	

*$p < .05$, **$p < .01$

[1]Binary outcome variable coded as 0 = increase; 1= decrease/no change

[2]Pre-enrollment service use defined as 0=none, 1=1 or more for IP and ED; continuous variable for OP visits

[3]Depression change was adjusted for outliers using Winsor method.

Note. Reference groups are listed in parentheses.

Results of Research Question 4

Research Question 4a. Which predictors of the BMVP framework are associated with achieving a clinical reduction in depression severity?

Hypothesis 4a. Among the intervention participants, those who achieved a clinical response in their depression severity differ significantly in predisposing, enabling, and need characteristics from those who did not achieve a clinical response.

Hypothesis 4a results.

This exploratory analysis focused on whether participants who achieved a clinical response to the intervention in their depression severity scores differed significantly from those who did not. A clinical response was defined as a 50% decrease in their PHQ-9 depression score at their last contact compared to their index visit score during the six months of follow up. Thirty-two (13.6%) intervention participants attained a clinical response during the follow up period. As expected, the average depression score between those who achieved a clinical response and those who did not during follow up was significantly different ($p < .01$). Those with a clinical response had a mean score of 10.42 ($SD = 4.57$) and those who did not had a mean of 14.58 ($SD = 3.90$). Less than half (44.9%) of the patients had no change between their first and last recorded PHQ-9 depression scores. In 10.2% of the intervention patients their depression scores worsened.

Independent samples *t*-tests were utilized to assess the relationship between the continuous predictors and changes in health services use. Pearson chi-square tests were utilized to assess the relationship between the categorical variables and changes in health services use. Results indicate that the two groups did not differ significantly in BVMP population characteristics, with the exception of the CI3 (illness severity). Independent samples *t*-test

revealed that those who achieved a clinical response had significantly lower average CI3 scores at their initial index visit, $t(45.47)=2.60$, $p<.05$, $d = 0.46$, 95% CI [.40, 3.18]. This represents a medium effect size (Table 33). Only one predictor of the BMVP framework's 'need' characteristics had a significant association, and none of the 'predisposing' or 'enabling' characteristics were significant (Tables 33 and 34).

Table 33

Results of Independent Samples t-tests Comparing Predictors by Clinical Response Compared to Non-clinical Response in Depression Severity

	M	*SD*	*t*	*p-value*	*95% CI*	*Cohen's d*
Age			.63	.53	[-3.16, 6.14]	0.12
No Clinical Resp. (*n*=204)	43.34	12.36				
Clinical Response (*n*=32)	41.85	12.79				
Depression Score - Index Visit			-.80	.42	[-2.17, .91]	-0.15
No Clinical Resp. (*n*=204)	15.22	4.07				
Clinical Response. (*n*=32)	15.84	4.35				
CI3 (illness severity)*			2.60	.01	[.40, 3.18]	0.46
No Clinical Resp. (*n*=204)	4.41	4.14				
Clinical Response (*n*=32)	2.62	3.54				
Comorbidity Score			.87	.39	[-.41, 1.05]	0.17
No Clinical Resp. (*n*=204)	1.60	1.97				
Clinical Response (*n*=32)	1.28	1.85				
Confidence Take Action at Index			1.06	.29	[-.41, 1.35]	0.20
No Clinical Resp. (*n*=199)	7.50	2.33				
Clinical Response (*n*=32)	7.03	2.39				
Importance of Condition at Index			-1.44	.15	[-1.44, .23]	0.28
No Clinical Resp. (*n*=199)	7.78	2.21				
Clinical Response (*n*=31)	8.39	2.08				

Table 34

Results of Pearson Chi-Square Test Comparing Predictors among Clinical Response and Participants

Predictors	*n*	*df*	χ^2	*p-value*
Gender	236	1	0.56	.46
Race	224	1	1.08	.30
Case Management	236	1	2.16	.14
SUD/Alcohol Use Diagnosis	236	1	0.1	.76
Existing Depression Diagnosis	178	1	0.8	.37
Pregnant	236	1	0.44	.51
Risk of Harm (Self/Others)	236	1	0.89	.35
Knowledge of Condition	236	1	.000	.99
PC-Beh. Health Provider Density	236	1	0.13	.72

*$p < .05$

Research Question 4b. Is achievement of a clinical reduction in depression predictive of changes in health services use?

Hypothesis 4b. Among the intervention participants, achievement of a clinical response status in depression severity predicts change in health services use, after controlling for confounders.

Hypothesis 4b results.

The preliminary Pearson chi-square analysis of change in health services use by whether the participant achieved a clinical response reveals a statistically significant difference by depression response status. A higher than expected number of participants with a clinical response in depression severity decreased/maintained their number of inpatient stays across periods compared to those who did not achieve a clinical response status, $\chi^2(1, N=236) = 4.98, p < .05$ (Table 35). This finding should be noted with caution because of the 32 participants who achieved clinical response status only three had inpatient stays during the pre-enrollment period.

Table 35

Results of Pearson Chi-Squares Between Depression Status and Change in Health Services Use (n=236)

		No Clin. Response	Clin. Response			
Service	Change	*n*	*n*	χ^2	*df*	*p* value
Inpatient Stays*	Increase	28	0	4.98	1	0.03
	Dec./No Change	176	32			
ED Visits	Increase	65	6	2.26	1	0.15
	Dec./No Change	139	26			
Outpatient BH Visits	Increase	42	3	2.29	1	0.13
	Dec./No Change	161	29			
Outpatient Phys. Visits	Increase	110	15	0.59	1	0.44
	Dec./No Change	93	17			

*$p < .05$, ** $p < .01$

To identify if depression response status predicts changes in health service use after accounting for the variance explained by the social determinants of health, a series of multivariate logistic regressions were conducted. The three models were developed using the same 12 social determinants of health and pre-enrollment health service use variables utilized in the prior analyses, along with depression severity response status to predict likelihood of change in health services use. As noted earlier, none of the participants with a clinical response in their depression severity had inpatient stays during the post enrollment period and only three had inpatient stays during the pre-enrollment period therefore no logistic regression models were run

for this type of service use. After accounting for social determinants of health and prior use, depression severity response status was not a significant predictor of change in health services use (Table 36).

Table 36

Summary of Multiple Logistic Regression Analyses of Clinical Response in Depression Estimating Odds of Decreasing/Maintaining Health Service Use (n=171)

	ED (BH/PHYS) Visits		OP (BH) Visits		OP (PHYS) Visits	
Predictor	OR	*95% CI*	OR	*95% CI*	OR	*95% CI*
Model 1						
Pre-enrollment Service Use	3.19**	[1.40, 7.29]	1.01	[0.94, 1.10]	1.03*	[1.00, 1.06]
Depression Severity Initial	0.97	[0.89, 1.06]	0.91	[0.82, 1.01]	0.98	[0.90, 1.06]
Gender (Female)	0.81	[0.35, 1.86]	1.44	[0.49, 4.19]	1.40	[0.64, 3.07]
Age	1.05*	[1.01, 1.09]	0.97	[0.93, 1.01]	0.99	[0.96, 1.02]
Race (Black/Other)	0.90	[0.36, 2.29]	1.39	[0.51, 3.79]	1.44	[0.60, 3.41]
Pregnancy (No)	1.98	[0.40, 9.88]	1.73	[0.16, 18.80]	0.61	[0.14, 2.62]
CI3 (Illness Severity)	0.99	[0.90, 1.09]	1.03	[0.91, 1.17]	0.98	[0.89, 1.08]
Case Management (No)	0.31**	[0.13, 0.73]	3.24*	[1.20, 8.74]	2.24*	[1.09, 4.63]
Existing Dep. Diagnosis (No)	1.49	[0.68, 3.25]	0.36	[0.12, 1.02]	1.50	[0.73, 3.10]
Knowledge at Index (Have enough)	0.79	[0.31, 2.02]	0.95	[0.35, 2.59]	0.72	[.30, 1.70]
Risk of Harm/Self-harm (No)	0.79	[0.31, 2.00]	1.78	[0.50, 6.36]	1.03	[.45, 2.38]
PC-BH Provider Density (Low)	1.22	[0.48, 3.15]	12.44**	[3.39, 45.69]	1.42	[0.59, 3.40]
Model 2						
Dep. Clinical Response Status (No)	1.86	[0.59, 5.88]	2.81	[0.63, 12.61]	2.14	[0.82, 5.57]
Hosmer and Lemeshow Test *p* -value	0.07		0.09		0.55	
Nagelkerke R^2	0.16	$\Delta R^2 = .01$	0.41	$\Delta R^2 = .02$	0.15	$\Delta R^2 = .02$

*$p < .05$, ** $p < .01$

Note1. Binary outcome variable: 0 = increase; 1= decrease/no change

Note2. Pre-enrollment Service Use: ED coded as 0=none, 1= 1 or more; OP visits are counts of claims

Note3. Reference groups listed in parentheses.

Results of Research Question 5

Research Question 5. Among the intervention participants, are there statistically significant associations between characteristics of the behavioral health coaching sessions (i.e., number of contacts and medium of delivery) and changes in depression severity and health service use?

Hypothesis 5a: The number of follow up contacts predicts likelihood of a decrease in depression severity, after controlling for confounders.

Hypothesis 5a results.

During the six-month post-enrollment period, the number of contacts with their behavioral health coaches varied. The mean number of behavioral health contacts for the 236 intervention participants was 3.01 (*SD*=2.46), ranging from 1 contact (30.9%) to twenty contacts (0.4%).

Preliminary independent samples *t*-test between the number of contact follow ups and the binary variable 'change in PHQ-9 scores' (0=increase/no change; 1=decrease) revealed a statistically significant relationship, $t(152.40) = -5.00$, $p < .001$, 95% CI [-2.25, -0.97]. Those who saw a decrease in PHQ-9 scores had significantly more contacts (*M*=3.90, *SD*=2.99) compared to those who had an increase/no change *(M*=2.28, *SD*=1.59), mean difference = -1.61 contacts. After controlling for confounding variables, the odds of participants decreasing their depression severity scores is 42% higher with each unit change, or additional contact, with their behavioral health coach during the six-month follow up period (Table 37). Furthermore, patients who reached a clinical reduction in their depression averaged 4.13 (*SD*=3.00) BH contacts, whereas those who did not averaged a statistically lower number of contacts, *M*=2.83 (*SD*=2.32).

Table 37

Summary of Hierarchical Multiple Logistic Regression Analysis of Number of Follow Up Contacts Estimating Odds of Decreasing Depression Severity[1] (n=171)

Variable	OR	95% CI
Model 1		
Gender (Male)	0.44	[0.19, 1.04]
Age	1.01	[0.97, 1.04]
Race (Black/Other)	1.18	[0.47, 2.95]
Pregnancy (No)	0.96	[0.20, 4.75]
CI3 - Illness Severity	0.99	[0.89, 1.06]
Case Management (No)	0.72	[0.91, 1.08]
Depression Severity Initial	1.06	[0.98, 1.16]
Prim. Care-Beh. Health Prov. Density (Low)*	3.26	[1.33, 8.00]
Knowledge of Condition (Have enough)*	0.39	[0.16, 0.96]
Existing Dep. Diagnosis (No)	0.75	[0.35, 1.60]
Model 2		
Number Follow Up Contacts**	1.417	[1.17, 1.71]
Hosmer and Lemeshow Test	0.68	
Nagelkerke R^2	.280	$\Delta R^2 = .12$

*$p < .05$, **$p < .01$

[1]Change in depression severity: 0 = increase/no change; 1= decrease

Note. Reference groups are listed in parentheses.

Hypothesis 5b: The number of follow up contacts predicts the likelihood of changes in health services use, after controlling for confounders.

Hypothesis 5b results.

A preliminary series of independent samples *t*-tests between the number of contact follow ups post enrollment and the binary variables representing change in inpatient stays, ED visits, and outpatient visits (0=increase; 1=decrease/no change) was conducted. A statistically significant relationship between contacts and ED visits only was found ($t(234) = -2.13$, $p < .05$, mean difference = -0.74, 95% CI [-1.42, -0.06]. Those intervention participants whose ED visits

decreased/maintained from pre to post enrollment had significantly more contacts (*M*=3.23, *SD*=2.65) compared to those whose ED visits increased (*M*=2.49, *SD*=1.84). The mean number of contacts did not differ significantly in comparing changes in the inpatient and outpatient analyses.

To control for the influence of the population characteristic covariates, hierarchical logistic regression was used. Model 1 included pre-enrollment service use, gender, age, race, pregnancy, illness severity, case management status at index, depression severity at index, provider density, knowledge of condition at index, and existing depression diagnosis. Model 2 included the number of follow up contacts between the coaches and participants during the six months of follow up. After controlling for the covariates, the number of follow up contacts was not a significant predictor of change in health services use (Table 38).

Table 38

Summary of Hierarchical Multiple Logistic Regression Analyses of Number of Follow Up Contacts Estimating Odds of Decreasing/Maintaining Health Services Use

	Change in Health Service Use from Pre to Post-Enrollment Periods[1]							
	IP (BH/PHYS)		ED (BH/PHYS)		OP BH		OP PHYS	
Variable	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1								
Pre-enrollment service Use[2]	1.41	[0.36, 5.59]	3.19**	[1.40, 7.29]	1.01	[0.94,1.09]	1.03*	[1.00, 1.06]
Gender (Male)	1.40	[0.43, 4.58]	1.26	[0.55, 2.90]	0.69	[0.24, 2.02]	0.74	[0.34, 1.62]
Age	1.01	[0.96, 1.06]	1.05**	[1.01, 1.09]	0.97	[0.93, 1.01]	0.99	[0.96, 1.02]
Race (Black/Other)	0.81	[0.24, 2.75]	0.85	[0.34, 2.14]	1.26	[0.47, 3.40]	1.33	[0.57, 3.11]
Pregnancy (No)	0.06**	[0.01, 0.32]	2.08	[0.43, 10.19]	1.73	[0.16, 18.45]	0.65	[0.15, 2.81]
CI3- Illness Severity	0.88	[0.78, 1.00]	0.98	[0.90, 1.08]	1.01	[0.89, 1.13]	0.98	[0.89, 1.07]
Case Management (No)	1.41	[0.48, 4.10]	0.32**	[0.14, 0.73]	3.51*	[1.31, 9.36]	2.22*	[1.08, 4.56]
Depression Severity Initial	1.02	[0.90, 1.15]	0.97	[0.89, 1.06]	0.92	[0.83, 1.02]	0.98	[0.90, 1.06]
Existing Dep. Diagnosis (No)	1.27	[0.44, 3.63]	1.49	[0.688, 3.24]	0.36	[0.13, 1.01]	1.48	[0.72, 3.23]
PC-BH Prov. Density (Low)	3.44	[0.91, 13.10]	1.20	[0.47, 3.07]	12.05**	[3.23, 44.99]	1.35	[0.57, 3.23]
Knowledge of Condition (Have enough)	0.46	[0.13, 1.71]	0.82	[0.32, 2.09]	0.96	[0.36, 2.62]	0.75	[0.32, 1.77]
Risk of Harm/Self-harm (No)	0.84	[0.21, 3.36]	0.80	[0.32, 2.03]	1.92	[0.52, 7.11]	1.04	[0.45, 2.42]
Model 2								
Number Follow Up Contacts	1.19	[.90, 1.58]	1.18	[.98, 1.43]	0.99	[.81, 1.20]	1.03	[.91, 1.17]
Hosmer and Lemeshow Test	0.74		0.66		0.41		0.73	
Nagelkerke R^2	0.20	$\Delta R^2 = .03$	0.18	$\Delta R^2 = .03$	0.39	$\Delta R^2 = .00$	0.13	$\Delta R^2 = .00$
n	171		171		170		170	

*$p < .05$, **$p < .01$

[1]Binary outcome variable: 0 = increase; 1= decrease/no change

[2]Pre-enrollment service use defined as 0=none, 1=1 or more for IP and ED; continuous variable for OP visits

Note. Reference groups are listed in parentheses.

Hypothesis 5c: The type of contact predicts likelihood of a decrease in depression severity, after controlling for confounders.

Hypothesis 5c results.

A preliminary Pearson chi-squares analysis was used to determine the likelihood of a bivariate association between type of contact and depression severity. Results revealed a statistically significant association such that patients who were contacted more frequently via telephone had a higher than expected decrease in their depression severity scores, compared to participants with Face to Face (FTF) or equal FTF-telephone contacts, χ^2 (2, N= 236) = 9.650, p = .008.

Multivariate logistic regression was used to determine if the association remained after controlling for covariates. The results indicated that compared to predominantly telephonic contact, those in the predominantly FTF contact are not more likely to see decreases in their depression scores (OR=0.75, 95% CI [0.90, 8.16]). Furthermore, program participants with equal FTF/telephone contact are actually less likely to decrease their depression severity compared to the predominantly telephone group (OR=0.28, 95% CI [1.34, 9.90]. Participants in the telephonic group were 3.6 times more likely to decrease their depression severity compared to those with equal FTF/telephone contacts (Table 39).

A post-hoc analysis was conducted to determine if there were significant differences in number of contacts by type of contact. An ANOVA with a tukey's b post-hoc tukey's b found significant differences in the average number of contacts. Participants in the primarily telephonic group had more contacts (M=3.9, SD=2.77) compared to FTF and equal FTF/telephone, F(2, 233=22.90, p < .00, est. η^2 = 0.164, a small effect size (Cohen, 1992).

Primarily FTF and equal FTF/telephone, however, were not significantly different from each other (*M*=2.12, *SD*=1.44; *M*=1.64, *SD*=1.17, respectively).

Table 39

Summary of Hierarchical Multivariate Logistic Regression Analysis of Type of Contacts Predicting Likelihood of Decrease in Depression (n=171)

Variable	OR	95% CI
Model 1		
Gender (Male)	1.83	[0.80, 4.21]
Age	1.02	[0.98, 1.05]
Race (Black/Other)	1.06	[0.43, 2.62]
Pregnancy (No)	1.43	[0.31, 6.67]
CI3 (Illness Severity)	0.98	[0.90, 1.06]
Case Management (No)	0.83	[0.39, 1.77]
Depression Severity Initial	1.08	[0.99, 1.18]
PC-BH Prov. Density (Low)*	3.06	[1.20, 7.81]
Knowledge of Condition (Have enough)	0.43	[0.17, 1.06]
Existing Dep. Diagnosis (No)	0.69	[0.33, 1.44]
Risk of Harm/Self-harm (No)	1.19	[0.51, 2.76]
Model 2		
FTF Predominant (Tel.)	0.75	[0.33, 1.67]
Equal FTF/Tel (Tel.)*	0.28	[0.10, 0.75]
Hosmer and Lemeshow Test	0.20	
Nagelkerke R^2	.22	$\Delta R^2 = .05$

*$p < .05$, **$p < .01$

[1]Outcome of depression severity: 0 = increase/no change; 1= decrease

Note. Reference groups are listed in parentheses.

Hypothesis 5d: The type of contact predicts changes in health services use, after controlling for confounders.

Hypothesis 5d results.

A series of Pearson chi-squares analyses were used to determine likelihood of a bivariate association between medium of contact and use of inpatient, ED, outpatient behavioral health, and outpatient physical health services. Results did not indicate that a statistically significant association exists between type of contact and change in health services utilization from pre to post enrollment periods at the alpha-level of $p \leq .05$. However, the association between type of contact and inpatient stays approximated significance, $\chi^2 (2, N=236) = 5.55, p = .06$.

Multivariate logistic regression was used to examine whether type of contact predicted the likelihood of a decrease in any of the health service types, particularly inpatient stays, after controlling for confounding variables. The results indicated that compared to predominantly telephonic contact, those in the predominantly FTF contact are not more likely to have increases in their inpatient, ED, or outpatient claims during the six month follow up period (Table 40). Furthermore, program participants with equal FTF/telephone contact are 4.6 times more likely to increase their inpatient stays during follow up compared to the predominantly telephone group (OR=4.64, 95% CI [1.35, 15.94]). Those with equal FTF/telephone contacts were not more likely to increase their use of ED, outpatient behavioral health, or outpatient physical health services compared to the predominantly telephonic group (Table 40). Overall, the type of contact did not predict changes in health services use, except with hospitalizations, in which more telephone contacts predicted a higher likelihood of decreased stays compared to equal FTF/telephone contacts.

Table 40

Summary of Hierarchical Multiple Logistic Regression Analyses of Predominant Type of Contacts Estimating Increase in Health Services Use

	Change in Health Services Use from Pre to Post-Enrollment Periods[1]							
	IP (BH/PHYS)		ED (BH/PHYS)		OP BH		OP PHYS	
Variable	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Model 1								
Pre-enrollment Utilization[2]	0.70	[0.17, 2.84]	0.32**	[0.14, 0.75]	0.99	[0.91, 1.06]	0.97*	[0.95, 1.00]
Gender (Male)	0.83	[0.25, 2.80]	0.85	[0.37, 1.97]	1.53	[0.52, 4.52]	1.38	[0.63, 3.02]
Age	0.99	[0.94, 1.04]	0.95**	[0.92, 0.99]	1.035	[0.99, 1.08]	1.01	[0.98, 1.05]
Race (Black/Other)	1.10	[0.32, 3.79]	1.16	[0.46, 2.97]	0.784	[0.29, 2.16]	0.76	[0.32, 1.79]
Pregnancy (No)	19.30	[3.13, 119.24]	0.44	[0.08, 2.30]	0.644	[0.06, 6.94]	1.52	[0.35, 6.66]
CI3 -Illness Severity	1.15	[1.02, 1.31]	1.02	[0.94, 1.12]	0.997	[0.89, 1.12]	1.03	[0.93, 1.13]
Case Management (No)	0.54	[0.17, 1.68]	2.80*	[1.19, 6.58]	0.27**	[0.1., 0.73]	0.44*	[0.21, 0.92]
Depression Severity Initial	0.99	[0.87, 1.13]	1.03	[0.94, 1.12]	1.088	[0.98, 1.21]	1.02	[0.94, 1.11]
PC-Beh. Health Prov. Density (Low)	0.32	[0.08, 1.29]	0.91	[0.35, 2.37]	0.09**	[0.02, 0.32]	0.74	[0.31, 1.78]
Knowledge of Condition (Have enough)	1.77	[0.46, 6.88]	1.06	[0.41, 2.75]	0.945	[0.34, 2.64]	1.30	[0.55, 3.09]
Existing Dep. Diagnosis (No)	0.75	[0.25, 2.24]	0.65	[0.30, 1.44]	2.779	[0.98, 7.91]	0.68	[0.33, 1.40]
Risk of Harm/Self-harm (No)	1.51	[0.36, 6.38]	1.35	[0.53, 3.47]	0.567	[0.16, 2.08]	0.95	[0.41, 2.20]
Model 2								
FTF Predominant (Tel.)	2.03	[0.57, 7.26]	1.01	[0.40, 2.54]	0.89	[0.31, 2.58]	0.99	[0.44, 2.21]
Equal FTF/Tel (Tel.)	4.64*	[1.35, 15.94]	2.1	[0.84, 5.23]	1.53	[0.50, 4.67]	1.20	[0.50, 2.88]
Hosmer and Lemeshow Test	0.55		0.41		0.32		0.67	
Nagelkerke R^2	0.24	ΔR^2 = .06	0.17	ΔR^2 = .02	0.4	ΔR^2 = .01	0.14	ΔR^2 = .00
n	171		171		170		170	

*$p \leq .05$, **$p \leq .01$

[1]Binary outcome variable: 0 = decrease/maintain; 1= increase

[2]Pre-enrollment service use defined as 0=none, 1=1 or more for IP and ED; continuous variable for OP visits

Note. Reference groups are listed in parentheses.

POST-HOC ANALYSIS OF PROCEDURES

Preliminary analysis of the counts and percentages of the most frequent procedures billed for from the administrative claims data generally depicts few differences in the types of procedures for among the intervention and TAU groups. In both groups, charges for inpatient stays (both behavioral and physical) across the pre and post periods were for hospital room and board and lab work. Other than the claim charge for ED visits (categorized as either 'moderate' to 'high severity'), the next most frequent charges were for pharmacy services and blood work within the EDs for both behavioral and physical health services in both treatment groups.

Differences between the two treatment groups were seen in the outpatient services. Table 37 reveals the top three procedures listed in the participants' claims. One major difference is the higher total number of procedures used by the TAU group compared to the intervention group, especially in addressing behavioral health needs. The intervention is a pilot for depression program, therefore many of the program's participants were most likely not receiving the mental health services they needed. After enrolling in the program, the number of mental health procedures billed for did increase by 20 percent and for physical health services by 21 percent. Both groups utilized alcohol and drug services during the pre and post periods. The intervention group utilized more psychotherapy services (pre use 16.1%, post use 18.6%) whereas the TAU group used more psychosocial rehab services (pre use 12.2%, post use 23.7%) in their outpatient behavioral health service needs. Case management was one of the top billed procedures within the outpatient physical health services for the TAU group; whereas in-home nursing care, therapeutic services, and in-hospital care for less than 24 hours were more often seen with the intervention group.

Table 41

Top Three Outpatient Services Utilized by Both Groups, Pre and Post Period

Intervention Group							
Pre Period				**Post Period**			
	Description	Count	%		Description	Count	%
Beh. Health		**465**		Beh. Health		**558**	
	Alcohol/drug services, methadone services	126	27.1%		Psychotherapy patient/family	104	18.6%
	Office outpatient visit	75	16.1%		Office outpatient visit	82	14.7%
	Psychotherapy patient/family	75	16.1%		Alcohol/drug services, methadone services	42	7.5%
	Case Management	64	13.8%		Case Management	42	7.5%
	TOTAL	**7182**			**TOTAL**	**8725**	
Physical	Office outpatient visit	707	9.8%	Physical	Office outpatient visit	750	8.6%
	SBSQ HOSPITAL CARE/DAY 35 MINUTES	139	1.9%		Therapeutic PX 1/> areas each 15 min exercises	168	1.9%
	ED visit high/urgent severity	116	1.6%		Nursing Care the Home; Registered Nurse Per Hour	166	1.9%
Treatment As Usual Group							
Pre Period				**Post Period**			
		1732				**1205**	
Beh. Health	Alcohol /drug services, group counseling	482	27.8%	Beh. Health	Psychosocial rehab services	286	23.7%
	Psychosocial rehab services	211	12.2%		Case Management	152	12.6%
	Alcohol/drug services, methadone services	199	11.5%		Alcohol /drug services, group counseling	99	8.2%
	TOTAL	**10622**			**TOTAL**	**9602**	
Physical	Office outpatient visit	953	9.0%	Physical	Office outpatient visit	899	9.4%
	Opiate drugs and metabolities procedures	252	2.4%		SBSQ HOSPITAL CARE/DAY 25 MINUTES	197	2.1%
	Case Management	229	2.2%		Case Management	170	1.8%

CHAPTER V

DISCUSSION AND CONCLUSIONS

This chapter includes a summary of the research results and implications of these findings in health care settings as they inform depression management programs among Medicaid populations. The present study examined the effects of a pilot collaborative care for depression program implemented by a health insurer covering Medicaid beneficiaries. The current study has the following three aims:

1. To evaluate the program's within and between groups effects on depression severity, acute (i.e., inpatient and ED) services, and ambulatory services.
2. To apply a health service utilization model based on vulnerable populations to identify characteristics associated with acute and ambulatory services use and depression severity.
3. To examine process characteristics of the collaborative care for depression program's contacts between the behavioral health coaches and patients and changes in depression severity and patients' use of health services.

A summary of the findings is provided in Table 42.

Table 42

Summary of Study Findings

Research Questions	**Findings**
1a. Does a within group difference exist in depression severity among the intervention group?	Participation in the intervention was associated with a statistically significant decrease in depression severity. The mean decrease in PHQ-9 scores was 2.28 points, representing a medium effect size, d = .56.
1b. Do within group differences exist in health services use among the intervention and TAU groups?	Among the intervention group only, outpatient physical health visits significantly increased between pre and post periods, representing a small effect size (r=-.10). Changes from pre to post periods were not significantly different in inpatient, ED, or outpatient behavioral health services. The TAU group had no significant changes in health services use from pre to post.
2a. Are Medicaid participants of the intervention program less likely to increase their inpatient stays and ED visits, and more likely to increase their outpatient visits from pre to post periods, compared to members receiving usual care for depressive disorders?	Using a subsample of matched intervention and TAU participants with diagnosed depression, analysis revealed that group (intervention or TAU) was not a predictor of change in health services use between the pre and post periods, after controlling for confounding variables.
2b. Is the interaction between group and level of comorbidity a significant predictor of health services use during the post-enrollment period?	Analysis of the matched subsample revealed that the interaction of group status and comorbidity was not a significant predictor of likelihood of inpatient stays, ED visits, or increases in outpatient health visits during the post period. As comorbidity scores increased, the odds of patients increasing their outpatient physical health visits increased 32%.

Table 42 Continued

Research Questions	**Findings**
3a. Using the Behavioral Model for Vulnerable Populations (BMVP) as a framework, what are the significant predictors of health service use among the intervention participants during the six months of follow up?	The following model characteristics were significant predictors of health services use: • Decrease inpatient use –not pregnant (**NEED**), lower CI3 illness severity (**NEED**) • Decrease ED use – prior ED visits (**NEED**), no prior case management (**ENABLING**), older age **(PREDISPOSING)** • Increase outpatient behavioral health use – no prior case management (**ENABLING**), lower primary care-behavioral health physician density (TN/TX health plans) (**ENABLING**) • Increase outpatient physical health services use – fewer prior physical health visits **(NEED);** no prior case management (**ENABLING**)
3b. Using the Behavioral Model for Vulnerable Populations (BMVP) as a framework, what are the significant predictors of decreased depression among the intervention participants during the six months of follow up?	The following social determinants of health were significant predictors of a decrease in depression severity: • Self-perceived sufficient knowledge of condition at index visit (**PREDISPOSING**), • Higher primary care-behavioral health physician density (MD health plan) (**ENABLING**)
3c. Among the intervention participants, does a significant association exist between the change in depression severity and change in health services used during follow up?	After controlling for the variance contributed by the model characteristics, no significant relation exists between the change in health services use and change in depression severity among the intervention patients. Changes in depression do not add to the model's ability to predict change in use of health services.
4a. Which predictors of the BMVP framework are associated with achieving a clinical reduction in depression severity?	Only one predictor of the 'need' characteristics, illness severity, had a significant association with a clinically significant improvement in depression severity. Those who achieved a clinical response had lower illness severity scores. None of the 'predisposing' or 'enabling' characteristics were associated with a clinical response.

Table 42 Continued

Research Questions	**Findings**
4b. Is achievement of a clinical reduction in depression predictive of changes in health services use?	Clinical reduction in depression was not a significant predictor of changes in health services use after controlling for covariates.
5. Among the intervention participants, are there statistically significant associations between characteristics of the behavioral health coaching sessions (i.e., number of contacts and medium of delivery) and changes in depression severity and health service use?	The odds of program participants decreasing their depression severity scores was 42% higher with each additional contact with their behavioral health coach during the six-month follow up period. Furthermore, patients with a clinical improvement in depression severity had nearly 50% more contacts with their coaches compared to those who did not achieve a clinical response.
	After controlling for covariates, the number of follow up contacts was not a significant predictor of change in any of the types of health services. Number of contacts does not add to the model's ability to predict change in use of health services.
	Compared to primarily telephonic contact, participants who had more frequent FTF contact with their coaches were not more likely to experience decreased depression. Furthermore, participants with equal FTF/telephone contact are actually less likely to decrease their depression.
	The type of contact did not predict changes in health services use, except with hospitalizations. Participants with more telephone contacts had a higher likelihood of decreased hospitalizations during the post period compared to those with equal FTF/telephone contacts.

Study Aim 1. Within and Between Group Effects on Depression Severity and Use of Health Services

Regarding within groups effects, the study found that participation in the program did result in a decrease in patients' depression severity by an average of two points on the PHQ-9 assessment tool during the six month follow up period. Furthermore, the average PHQ-9 score during the follow up period was 13, which is a reduction from the moderately severe to moderate depression severity range (Kroenke, Spitzer & Williams, 2001). While this preliminary finding is positive and encourages continued participation in the program, caution should be noted as this may represent a natural regression to the mean. Without a control group, it is not possible to state the decrease resulted from program participation.

Administrative claims data were available for all Medicaid patients, allowing a matched comparison group to be identified using 1:1 propensity score matching to examine the between groups effect of the intervention on health service use. While the within group analysis of health service use from pre to post periods revealed an increase in outpatient physical health visits among the intervention group, where there was not one with the TAU group, the other hypothesized changes in inpatient, ED, and outpatient behavioral health visits were not found. Furthermore, after analyzing a matched subsample of participants all with diagnosed depression, results did not support participation in the collaborative care intervention as a predictor of changes in use of health services from pre to post periods. Discussions with the program's director clarified that during the first six months following the post-enrollment visit the behavioral health coaches are in the active phase of managing depression (D. Johnson, personal communication, June 1, 2017). Six months was most likely not a long enough time period to observe significant changes in the patient's use of health care services especially given

depression management was the primary focus of the brief coaching sessions. Furthermore, the relationship between depression and health service use may be serial and not concurrent. Once depression is better managed, it may take even longer to see a difference in overall health service use. Another possibility is that the treatment dosage, in this case the number of successful contacts, may not have been adequate to have an impact on health service use. On average, participants had three contacts with their BH coaches during the six months following enrollment in the program.

The lack of significant differences in health service use is similar to a study by Kim et al. (2013) who tested the effectiveness of a telephone care management intervention implemented with Medicaid beneficiaries in a managed care organization. Their study also focused on an integrated care program designed to improve quality of care for Colorado Medicaid recipients with multiple chronic conditions, including depression. They did not find significant differences between the intervention group and the randomly assigned control group in use of ED services, inpatient stays, visits to PCPs, or specialist visits. The researchers noted difficulties in keeping participants engaged and maintaining contact by telephone, as well as differences in the design of their care management program and established characteristics of evidence-based collaborative care programs (Kim et al., 2013). Within the current study, the overall low number of contacts and reported difficulties in reaching intervention participants by the BH coaches may have contributed similarly to the lack of significant differences in health services use between the two groups.

Another factor important to consider with the current study's sample was the reliably higher number of intervention participants diagnosed with a substance use and/or alcohol use disorder compared to the TAU participants. The literature regarding the co-occurrence of

depression and SUD describes low-income minority adults with this particular comorbidity as having higher rates of ED visits and behavioral health hospitalizations as well as more use of outpatient mental health services and social services (Chang et al., 2015). A recent study of data from the 2008-2014 National Survey on Drug Use and Health found that nearly 8 million U.S. adults (3.3%) had 12-moth co-occurring mental illness and substance use disorders (Han, Compton, Blanco & Colpe, 2017). Among these adults, more than half (52.5%) received neither mental health nor substance use treatment in the past year, indicating a clear gap between prevalence and treatment of these conditions (Han, Compton, Blanco & Colpe, 2017). Services for this population are complex and often fragmented as they require psychosocial, general medical, mental health, and substance abuse treatments (Chang et al., 2015). Ongoing barriers to the current study's participants in receiving care and the overall high need for behavioral health (both mental and substance use) and physical health services may have contributed to the lack of difference in health service use between the intervention and TAU groups.

The hypotheses regarding interactions between group status and degree of comorbidity were not supported. However, a main effect was found such that participants with more comorbid conditions had a higher likelihood of increasing their outpatient physical health visits during the follow up period. While the study's hypotheses regarding the main effect of intervention participation or the interaction of group and comorbidity were not supported, the analyses for the Study 1 aim identified several covariates that were significant predictors of health service use, regardless of group status. The models estimating the interaction of comorbidity and group status predicting use of health services in the post period found prior period health service use significantly increased the likelihood of utilizing more health care during the post period. This was found with prior inpatient and ED services; whereas prior

outpatient physical health visits was associated with a slightly lower likelihood of increased future outpatient physical health visits. Other studies have also found that having two or more prior ED visits/hospitalizations is a strong predictor of ED use (OR=3.17, 95% CI, 0.704-0.717) (Takahashi et al., 2016). Such findings can help program managers better target patient groups to influence more appropriate use of health services, among Medicaid recipients suffering from depression. Managers noting low use of outpatient services or missed appointments may wish to follow up with these patients to identify and address barriers to accessing outpatient care.

Another implication of these findings is the use of big data in health care to design more patient-centered services. As the field of health information technology continues to grow and become a key component of many health care companies, individual and environmental level factors should be examined for inclusion in predictive models that assess risk for higher acuity services. The ability to identify these patients early in their disease progression and manage it in ways that address barriers to service for Medicaid patients with depression are an important contribution of those who work with health care data. In a recent *Health Affairs Blog* (http://healthaffairs.org/blog/) article, Lustig and Castel of Cigna (2017) explain that with the myriad of comprehensive data sets collected by managed care companies they are in a prime position to contribute high-quality publications and presentations that can inform a number of areas in health care and bring greater credibility to policy debates. However, many do not because it has not generally been part of the business model of health care companies, with the exception of pharmaceutical companies. Yet, sharing data with health service researchers and studies by managed care companies on their innovative health care benefit products, such as the pilot program in the current study, has the potential lead to healthier insured populations and more competitive pricing among health insurance companies (Lustig & Castel, 2017).

Study Aim 2. Application of Behavioral Model of Vulnerable Populations to Identify Predictors of Outcomes with the Collaborative Care for Depression Participants

The second aim focused on behaviors of the intervention participants to identify predictors of health service use and depression reduction specific to Medicaid patients. This population in general requires greater health resources for treatment management due to the confluence of community and individual-level risk factors (Shi & Stevens, 2010). In addition to depression care management, participants may also struggle with substance/alcohol abuse concerns, chronic physical health conditions, and limited financial resources and social support that influence their ability to access and receive services. The National Institutes of Health (NIH) report on the Science of Behavior Change recommended that multiple behavior change be a top research priority along with translating that research into public policy (NIH, 2009). One of their key themes was integrating multilevel approaches to behavior change that links the individual- and population-level analyses and the need to study brain, person, and environmental factors in tandem as well as longitudinally (NIH, 2009).

The current study served as an initial attempt to apply an ecological framework to study the environmental context of behavior and behavior change in an at-risk population suffering from depression with an eye towards model-building with significantly larger data sets. Predictors of change in health service use and depression severity were identified by estimating multivariate logistic regression models based on the Behavioral Model of Vulnerable Populations (Gelberg, Anderson & Leake, 2000). Among the participants of the collaborative care for depression intervention the predictors that significantly increased odds of reducing acute care, increasing outpatient visits, and reducing depression severity were often variables characterized as ‘enabling’ and ‘need’ variables from the BMVP framework. This is supported

in the literature as well that those variables most proximal to health service use are often significant predictors of those outcomes, particularly among patients with mental disorders (Fleury et al., 2014).

The study, however, did not find a significant relationship between depression severity and use of health services among the intervention group. Although originally hypothesized that changes in health service use would be associated with decreased depression severity based on the BMVP framework, recent reports explain this finding. As noted by a 2016 report on collaborative care for depression programs, even when care coordination programs are successfully implemented and depression outcomes are improved, cost reduction may not follow (APA, 2016). As the report states about DIAMOND, similar collaborative care for depression program, these programs were not designed with the goal of reducing utilization of acute services in emergency department and hospitals. The report notes that some patients with depression may not use many health services at all therefore cost reductions may be difficult to assess. If continuity and coordination of care is truly the goal of collaborative care programs, interventions that include home visits or social services may become necessary additional services (APA, 2016).

Predisposing characteristics. An unexpected finding was that the odds of an increase in ED visits was higher with younger age. Younger aged adults (18-29) visiting the ED more frequently than older aged adults (45-64) was also reported in a national study of emergency room use in 2013 and 2014 (Gindi, Black & Cohen, 2016). Their analysis revealed that regardless of type of coverage, younger adults were more likely to visit the ED one or more times in the past 12 months compared to the older group. Additional analysis by Gindi et al. (2016) revealed that within the Medicaid population, younger adults also had lower odds of

having seriousness of their medical condition as the reason for the ED visit compared to older adults, OR=0.37, 95% CI, 0.26 -0.52).

Among the intervention patients in the current study, having a prior depression diagnosis was not significantly associated with changes in inpatient or ED service use. These findings are similar to those by Bruenig, Shaya, Tevie & Roffman (2015) that found that medical utilization for acute care did not significantly increase for a sample of hypertensive patients after a depression diagnosis compared to those without a depression diagnosis. Bruenig et al. (2015) also reported that a diagnosis of depression did account for nearly seven additional outpatient medical encounters with non-mental health providers annually. Likewise, in the current study, having a depression diagnosis was associated with being 3.2 times more likely to increase use of outpatient behavioral health services when amount of depression change is included in the model (Table 32). Existing literature supports identifying patients with depressive disorders as soon as possible in order to set them up with ongoing health services within their communities to more appropriately manage their chronic medical and behavioral health conditions rather than episodic care in acute settings. Having a depression diagnosis enables PCPs to diagnose, treat, and be reimbursed for behavioral health disorders (Kautz, Mauch & Smith, 2008).

The current study also found that participants who felt they had sufficient knowledge of their medical conditions had better odds of decreasing their depression severity compared to those who felt they needed more information. This may relate to the patient's readiness to change their lives and better manage their depression as reflected in their self-assessed understanding of their conditions and the steps needed to manage those conditions. One theoretical approach for addressing behavioral changes is the Transtheortical Model (TTM) of individual behavior change (Prochaska & DiClemente, 1983). The TTM posits that behavior

change occurs along a continuum of readiness to make and maintain specific health behaviors while progressing through a series of stages: pre-contemplation, contemplation, preparation, action, and maintenance. Interventions can be more successful and met with less resistance when patients are met at the stage of change they are at, or stage-matched interventions, rather than a 'one size fits all' approach (Prochaska & DiClemente, 1983). Vancampfort et al. (2016) studied changes in physical activity among persons with affective disorders in order to understand the motivational mechanisms behind the TTM stages. They found that motivation is more autonomous for those patients in the later stages of the TTM (i.e., action and maintenance) compared to those in the earlier stages. As a point of reference, the TTM literature states that a basic rule of thumb for at-risk populations is that 40% are in pre-contemplation, 40% are in contemplation, and only 20% are in the preparation stages (Prochaska & Velicer, 1997).

Enabling characteristics. Provider density and case management at the initial visit in which the participant enrolled in the intervention were significant predictors.

Primary care/behavioral health provider density. The predictor 'primary care/behavioral health provider density' was significantly associated with outpatient behavioral health use and depression reduction. The current study found that intervention participants living in the area with a higher primary care and behavioral health provider density, specifically Baltimore county, MD were 12 times more likely to decrease their outpatient behavioral health service visits compared to those in the lower provider density areas of the TN and TX health plans. Maryland has behavioral health services (mental health and substance abuse) as a carve-out benefit for Medicaid patients and thereby require referrals to obtain these services from a separate behavioral health organization contracted to provide them. TN and TX have behavioral health services integrated into their Medicaid managed care contracts.

Another important historical and environmental-level influence of note is that this study occurred during 2014-2015 as states were deciding on whether to expand their Medicaid coverage through the passage of the Affordable Care Act in 2010. Of the three states in this study, Maryland had implemented Medicaid expansion; TN and TX had not as of December 1, 2016 (http://www.ncsl.org/research/health/affordable-care-act-expansion.aspx). The lower likelihood of increased outpatient behavioral health services in the current study may have been related to the expansion, or other behavioral health funding strategies in place such as the 1115 waiver with Maryland, as more people with unmet behavioral health needs entered the Medicaid system in Maryland. This may have potentially reduced availability of providers to those already enrolled in Medicaid. Of note, participants in the MD health plan already had lower outpatient behavioral health office visits compared to the TX/TN participants during the prior six month period, M= 1.17(SD=4.35); M=2.78(SD=6.19), respectively. Their post period/follow up office visits decreased in MD and increased in TX/TN, M=0.89(SD=4.92); M=3.87(SD=6.99), respectively. This finding also points to the need for Medicaid MCOs to increase the number and geographical spread of their Medicaid behavioral health providers across all health plans as the lower provider density health plans of TX and TN were more likely to see increases in their outpatient behavioral health visits.

However, intervention participants in MD were 3.3 times more likely to experience depression reduction compared to those in TX and TN. Again, this finding may be more reflective of the brief counseling efforts and frequency of contacts from the MD health plan's Behavioral Health coaches, rather than provider density. Intervention participants in the MD health plan had significantly higher follow up contacts with their coaches compared to

participants in TX and TN, M = 3.49 (SD = 2.86), M=2.47 (SD=1.76), respectively, t(209.06)= -3.25 , p < .01, 95% CI [-1.62, -0.42].

Case management. Case management as a predictor of health services use was also not in the expected direction. Increased care coordination with patients with depression was expected to lead to reduced hospitalizations and ED visits and more appropriate use of outpatient behavioral health services, such as more regularly attended individual or group therapy visits. In the current study, being in case management at the time of the initial index visit was associated with a higher likelihood of increasing ED visits and a higher likelihood of decreasing/maintaining outpatient behavioral health and physical health visits. One potential explanation for this finding is that because there was increased contact between the Behavioral Health coaches and their patients some of their psychological and pharmacological supports may have been addressed or mitigated through those contacts thereby reducing the need to come in to the office for therapy or prescription-related concerns. This may be even more so the case with patients who historically have had limited access to behavioral health specialists within outpatient settings (Thomas et al., 2005; Teh et al., 2010).

Another explanation to be taken into consideration is the insurance company's practice of identifying those with higher CI3 (chronic illness intensity index) scores and service utilization and to prioritize patients for case management services (MHPA, n.d.). Therefore those in case management typically had a higher disease burden. Among the current study's participants, their CI3 scores and Charlson Comorbidity Indices were positively correlated (r = .63, p < .000). Over half of the program participants were already seeking treatment at the ED and this pattern of utilization most likely continued into the post-enrollment period indicating more of an access to services barrier rather than an increase in emergency care. The frequent use of the ED among

persons with Medicaid coverage is well-documented in the literature and is attributed to limited primary care provider networks participating in Medicaid (GAO, 2011; Rui, Kang & Albert, 2013).

Case management and care coordination services are high-resource activities for health care organizations, however they are necessary given the increased prevalence of chronic illnesses with multiple specialists, an aging U.S. population, and the ever-tightening budgets of government health insurance programs. Medicaid case management covers services that aid beneficiaries in accessing medical, social, educational, and other needed services; furthermore, targeted case management are services specific to groups of enrollees, such as those with developmental disabilities or chronic mental illness (CMS, 2007). Since 1986 Medicaid has provided states with mental health treatment options that provide intensive community-based supports to people with serious mental health disorders including targeted case management. In the early 1990s Medicaid expanded services to include psychosocial rehabilitation services (Andrews, Grogan, Brennan & Pollack, 2015). States have also sought to enhance Medicaid's case management through the Primary Care Case Management programs to include more care coordination, especially for the chronically ill and disabled patients with complex medical and behavioral health needs (Verdier, Byrd & Stone, 2009). While case management services are available for those on Medicaid through behavioral health homes, the current study's findings point to the need for strategies that work best based with this population's needs rather than a one-size-fits all approach. This is as important as ever as health care moves towards value-based reimbursements rather than fee-for-service and reimbursements are tied to quality and outcomes. Tailoring case management plans to the individual along with providing case managers with timely access to ED use and hospital admissions information to assist patients in transitions of

care can increase effectiveness of these services (Kim et al., 2013). Other strategies include creating more linkages between community supports, primary care, and behavioral health agencies and incentivizing these efforts through accountable care organizations would better serve the complex bio-psychosocial needs of the population of adults similar to those in the current study (Chang et al, 2015). In one study of a housing and case management program with homeless adults with chronic illness, social services that connected them to stable housing resulted in lower ED visits, hospitalizations, and costs (Sadowski et al., 2009). Case management in this program included coordination of housing, social services, and patient medical needs (Sadowski et al., 2009). Increased community and health connections through targeted case management for Medicaid recipients are needed.

Need characteristics. The finding that the odds of inpatient stays being lower or unchanged were higher for participants who were not pregnant compared to those who were pregnant was expected as well as increases in inpatient stays were more likely with patients with higher illness severity. The current study found illness severity to be a predictor of inpatient use, which is similar to a 2010-2011 study by Takahashi and colleagues (2016) who calibrated a risk prediction model of inpatient and ED utilization. They found the number of comorbid conditions to be a strong predictor of inpatient and ED use within one year (Takahashi et al., 2016). Patients in the highest medical tier (0= no conditions to 5=more than 10 conditions) had an odds ratio of 3.50 (95% CI, 2.78-4.42) of incurring a hospital/ED visit during the one year assessment period. Among the intervention participants, having one or more ED visits during the prior period was associated with a higher likelihood of decreasing or maintaining ED visits in the post period. This may appear counter-intuitive but what is most likely occurring is that participants

are maintaining an elevated level of ED visits rather than decreasing their ED visits. Further exploration is required.

Study Aim 3. Association Between Collaborative Care for Depression Program Process Measures and Outcomes

The third aim of the study focused on two process measures, the number of contacts between behavioral health coaches and participants and the type of contact. Experts on collaborative care programs state that for these programs to have ongoing success a mixture of clinical outcome and process measures are needed (APA, 2016). They believe that the success of these models is not only based on the types of services provided, but how care is coordinated and when the services are provided (APA, 2016). The PHQ-9 is a well-established clinical outcome measure for depression severity, but process measures such as screening rates, financial stewardship, service timeliness, and access rates, are needed to maintain fidelity to the core processes necessary to reach expected clinical outcomes (APA, 2016).

Number of contacts. There was mixed support for the study's hypotheses regarding number of contacts and odds of decreasing severity symptoms and use of health services. Positive changes in depression severity were observed in association with more frequent BH coach contacts, however support for follow up characteristics and positive changes in health services use was not found. Patients who achieved a clinical response in their depression averaged 4.13 (*SD*=3.00) BH coach contacts, whereas those who did not averaged a statistically lower number of contacts, 2.83 (*SD*=2.32).

The number of behavioral health coach contacts was not a significant predictor of health service use from pre to post periods. Within the current study, the average number of follow up contacts, either telephonically or FTF, was three over a six-month period. This may be too

infrequent and too short a time period for coaches to influence changes that encourage appropriate health service use. In a related study, Hamar et al.'s (2011) study of nurse-delivered care calls to German seniors with chronic conditions reported a statistically significant drop in inpatient admissions comparing those in the program to those not participating in the calls. The researchers reviewed hospital admission data one year prior to and one year after the intervention began and found a dose-response relationship in which the number of admissions decreased as the number of nursing care calls increased. Extending the follow up period to one year rather than six months may have found a significant decrease in use of acute services. However, it is also important to recognize this was a study of German seniors with chronic physical health conditions, not behavioral health disorders (Hamar et al, 2011). Differences in Germany's health care delivery system, patient age, and the longer study period in Hamar and colleagues' research, as well as the known behavioral health disease burden in the current study, may have contributed to the lack of significant changes in health services use seen in the current study.

Type of contact. This study also found that the medium through which the behavioral health coaches communicated with their patients was associated with a decrease in their depression severity scores and inpatient stays. Access to care barriers for Medicaid patients, such as time constraints, transportation needs, lack of available and accessible services, and cost are often reasons why patients with depression do not attend psychotherapy sessions regularly (Mohr et al., 2010). Contacts that do not require the patient to come into the clinic regularly may be more effective given these barriers. Previous research supports in-person contacts over telephone-based contacts in care coordination programs. An evaluation of 15 programs between 2002 to 2008 found that in-person contact during the patient's first year in a care coordination programs led to more successful program outcomes compared to over the telephone, however the

evaluation was of Medicare demonstration programs (Verdier, Byrd & Stone, 2009). Medicaid populations are a different demographic with different health and social challenges compared to Medicare patients. The current study did not find primarily FTF contacts to be superior to primarily telephonic contacts. Furthermore, having equal numbers of telephonic and FTF contacts was associated with a lower likelihood of depression reduction. A similar pattern was seen regarding hospitalizations and participants contacted predominantly using the telephone. Compared to equal FTF/telephone contacts, those contacted more by telephone were less likely to increase their admissions during the six-month follow up.

In a study comparing telephone-based cognitive behavioral therapy (T-CBT) and FTF-CBT among participants with depression, Mohr and colleagues also found that T-CBT was not inferior to FTF-CBT when comparing attrition rates and depression outcomes (Mohr et al., 2012). The researchers also found that at the six-month follow up after the CBT 18-week sessions had ended, the telephone-based group had inferior depression outcomes compared to the FTF treatment group. The researchers noted in the study's limitations that the sample was fairly well educated, therefore in the long-term the generalizability of the findings to lower socioeconomic groups may be problematic (Mohr et al., 2012).

Although in the current study the participants were not required to choose either FTF or telephone-based sessions solely, those with contacts primarily via the telephone may have perceived less barriers to access and were more consistently in contact with their coaches. In fact, the data appears to support this. The 132 patients who primarily contacted their coaches via the telephone had an average of 3.88 (SD=2.77) contacts whereas the 57 primarily FTF patients averaged 2.12 (SD=1.44) contacts (t=5.71, df=180.73, CI [1.15, 2.36], $p < .000$), revealing that contacts were more frequent among the telephone-based group than the FTF group. These

findings suggest finding a mix of in-person and telephonic follow-up strategies, with more opportunities via the telephone, may be more effective within collaborative care programs.

Given the ubiquity of mobile devices by the general population, the use of telehealth has become a viable approach to addressing the chronic conditions and mental health needs of patients who are homebound or living in rural areas (Gellis, Kenaley & Have, 2013). One integrated telehealth intervention of older patients with chronic illness and depression incorporating daily telehealth nurse monitoring found that depression scores were 50% lower and ability to self-manage medical conditions were significantly improved compared to the usual care with in-home nursing and psychoeducation group (Gellis, Kenaley & Have, 2013). At 12-months follow up, ED visits were also significantly reduced Gellis, Kenaley & Have, 2013). A 2015 Commonwealth Fund study surveying 200 leaders at urban and rural community health centers reported high levels of cell phone adoption among minority and low-income people in the U.S. noting frequent use of texting and mobile Internet (Broderick & Haque, 2015). Survey results identified chronic disease management, preventive care practices, and wellness activities as primary areas to effectively engage patients in safety-net communities and enhance care delivery (Broderick & Haque, 2015).

LIMITATIONS

There were a number of limitations with this study. These limitations were associated with lack of randomization, sample size, length of follow up, and availability of data including depression scores and case management for both the intervention and TAU groups.

Because this was quasi-experimental, or nonexperimental, research, the lack of random assignment to the intervention or TAU group was a major barrier. Random assignment occurs when the researcher is able to control the participants' level of exposure to the independent

variable (IV) while controlling for all other confounding variables (Tabachnik & Fidell, 2001). Any variation in the dependent variable between the control and intervention groups would be attributed to the IV. However, in this study the levels of the IV could not be manipulated by the researcher. The IV was either assignment to the intervention or TAU, or within the intervention group, assignment to one of the three types of contact groups. Any statistically significant differences in the DVs indicates the two variables are related, but no causal association can be implied ((Tabachnik & Fidell, 2001).

Another key limitation was the number of participants in collaborative care program. A much larger sample size with thousands of patient is needed to be able to measure the numerous factors that constitute the mix of psychosocial, physiological, and community-level variables that affect a patient's decision to seek care for their behavioral and/or physical health needs. As a pilot program, this was not feasible within the time frame of the dissertation data collection period. Although informed by the Behavioral Model of Vulnerable Populations (Gelberg, Anderson & Leake, 2009) this study addressed a limited representation of the applicable factors. This was due to data availability and accessibility, reliability of the collected data, and the need to restrict the number of predictors to avoid overestimation of the predictive models. The study generally used an "intent-to-treat" approach by including all Medicaid members at each participating primary care practice who agreed to participate, regardless of the number of successful behavioral health coach contacts after the first follow up contact (i.e., each participant had a minimum of two contacts). This was because participants were not considered drop-outs during the study period and coaches continued to attempt to contact them even if a significant amount of time had passed since the last successful contact. However, excluding all participants who initially agreed to participate in the study but only attended the initial collaborative care for

depression program enrollment appointment reduced the initial available sample from 574 to 236, therefore lack of statistical power was a concern. Moreover, the loss of a significant number of program participants due to lack of follow up data is a limitation because those who remained in the program may have been characteristically different from those who did not have at least one follow up visit. The study program participants may have been more motivated to find ways to improve their health status. Thirteen percent of the intervention participants were also missing data on the predictor variable ICD 9/10 depression diagnosis. This reduced the statistical power to identify significant predictive factors of each outcome.

This study was not conducted in a research environment therefore patients were not randomly assigned to either the collaborative care program or treatment as usual. The comparison group was identified using propensity score matching, which is appropriate to do when a true control group is not available. Even with using propensity score matching, I was limited in the list of covariates I could use to perform the initial matching technique. Once I received the list of matched patients, I then asked for the full list of covariates based on the BMVP to be used in the analyses but it was at that point that I found the groups were dissimilar on SUD/alcohol use diagnoses.

Also related to the non-research setting in which the study was conducted is the lack of information on the specific clinical guidelines the providers followed within their primary care practices for both the TAU and intervention participants. The intervention participants came from the same five clinics within the three participating health plans, however the TAU participants came from a number of different primary care clinics carrying the Medicaid MCO's insurance. The only exclusion criteria for the TAU patients was that their clinics not be participating in the Collaborative care for depression pilot program to limit any contamination

effects amongst providers within the participating clinics. The intervention program included depression monitoring and assessment that informed treatment, regular contacts with Behavioral Health coaches, and a consulting psychiatrist and psychologist as part of an enhanced primary care model. It is not known to what degree other primary care clinics in the comparison group may have utilized similar aspects in their treatment plans. They were not following a predetermined protocol of services as part of the study. Because they were treating similar patients who were also covered under the same Medicaid health plan, the types of services provided were most likely not vastly dissimilar based on what are allowed benefits, however the qualitative differences in services is unknown. The participating Medicaid MCO provided the current procedural terminology (CPT) codes billed for with each encounter, which may provide insight into the providers' clinical practices, however this was not a focus of the current study.

Working across different data sources within the company also brought challenges. PHQ-9 scores and case management data came from different databases as the administrative claims data. Lack of PHQ9 depression severity data for the TAU group was a major limitation in being able to have a more robust research design to answer the question of whether or not the intervention had an effect on participants' depression. This measure is not typically included in claims data therefore this portion of the analysis was a single group pre-post due to the lack of availability of depression severity scores in both groups. It is not known if the decrease in depression severity found from pre to post time periods was due to the threat to internal validity, regression to the mean, or if comparative data would have found the change was specific to the program participants. The case management variable was provided from the same database housing the PHQ-9 data, which primarily serves the needs of the nurse case managers in tracking their activities with patients versus creating a stable database for reporting purposes. The need to

impute case management status in the current study due to missing data may have affected the results. It is not known how accurately case management status at index visit was estimated from the logistic regression model that was used. Another key point in working with health data repositories is the need for data to be fully and accurately entered into these systems and for the researcher to have explicit knowledge of what is actually being captured within those databases. This is necessary to confidently report findings that can affect future health service delivery.

Lack of data on other factors noted to influence health services use was a limitation. Examples include, marital status, homelessness, transportation, and medication information (Gelberg, Anderson & Leake, 2009). Medication adherence for behavioral health conditions is described in the literature as being very poor (APA, 2016). As stated earlier, Takahashi and colleagues (2016) identified specific medications as risk predictors of hospitalization/ED use. Medication adherence data is an important characteristic to include in future studies. Although self-reported medication adherence information was available for the intervention group**,** it was not clear if the behavioral health coach was asking about behavioral health or chronic physical conditions. My discussion with the behavioral health coaches revealed they were unclear if they were to ask about behavioral health meds or all medications, therefore the data were not included. Data on pharmacy prescriptions filled for each participant would have been more reliable but was not available for request for the current study.

Furthermore, a longer follow up period may have revealed differences in health service use. At least two to three years post enrollment may be more appropriate, particularly with number of hospitalizations as these are low prevalence occurrences. Lin et al. (2012) examined the effect of a telephone-based health coaching disease management program on cost and healthcare use among Medicaid patients with chronic physical/medical conditions and a matched

comparison group. They reviewed claims data one year before and two years after enrollment. Comparative analysis of utilization rates before and after enrollment did not result in significant differences in the amount of change between the two groups in number of ED visits nor hospitalizations (Lin et al., 2012). However, the researcher runs into attrition issues or gaps in data as many Medicaid recipients do not consistently stay on Medicaid for long periods of time.

The short amount of time between when study data were collected and the initial implementation of the pilot collaborative care for depression program was another limitation. A recent study of a similar integrated delivery system reform program, Total Care and Cost Improvement Program, a patient-centered medical home model implemented by CareFirst BlueCross BlueShield, examined changes in spending and utilization. The researchers compared claims data from members enrolled with participating primary care physician groups to similar members enrolled with non-participating physician groups between 2010 and 2013. Differences in changes in spending (both inpatient and outpatient) and utilization (primary care and specialist visits) over the four-year period were not significant (Afendulis et al., 2017). Based on the qualitative data collected, one explanation the authors provided for the lack of significant findings was that during the early period of the program many physicians did not fully understand the payment incentives and program information. Although provider support was positive, growing pains did occur including nurse case manager turn-over, low physician engagement, and few patient care plans being written than projected (Afedulis et al., 2017). The current study's intervention suffered from similar challenges of staffing turnover and clinic engagement throughout the study period. Moreover, data from the first month of the program through the first two year were collected in order to include as many participants as possible.

However, the first three to six months was a period when clinic, program staff, and computer systems were being put in place and perhaps should not have been included in the analysis.

Finally, findings from this study cannot be generalized beyond populations similar to the study participants. Therefore the findings are limited in generalizability to Medicaid patients with similar demographics, depression severity, degree of comorbidity, and within counties similar to those in the study. Medicaid service coverage and eligibility requirements differ from state to state. Replication of the current study would require focusing on short-term outcomes of depression severity and health service utilization up to six months.

STUDY STRENGTHS

The current study showcases a number of strengths. A key strength of the study is the examination of an evidence-based intervention for the management of chronic depression within a Medicaid population. The literature on collaborative care for depression programs dates back to the late 1990s and has consistently found support in this approach's ability to decrease depression severity. Through stepped care, the behavioral health specialist starts with the lowest intensity evidence-based treatment and based on the patients' response, can then change to a higher intensity treatment as deemed appropriate based on depression management clinical guidelines (Seekles et al., 2011). The pilot program took a variation on the stepped care approach because patients were at different treatment approaches in their depression management and either stepped up or stepped down the intensity of the treatment. These decisions were made through patient monitoring and rounding with a consulting psychologist and psychiatrist. For patients with complex needs or treatment resistant patients this was another strength of the intervention as it provided more direct consultation and increasing access to mental health care for those in this population most in need (American Psychiatric Association

[APA], 2016). Ongoing behavioral health assessments through valid and reliable screening tools like the PHQ-9 assist in identifying those patients needing more intense treatment (APA, 2016). Access to specialty care is limited for most patients without complex health needs, and is even more so when working within the confines of a network of Medicaid providers. Collaborative care programs enable providers to target much-needed resources among their patient population through measurement-guided stepped care. By identifying patient characteristics that may predict likelihood of appropriate use of healthcare services, which the current study did, we can more judiciously manage the limited resources of specialty mental health care.

A second strength of this study is the focus on adult Medicaid patients with depression using data from a managed care organization. Depending on the state, as many as 20% to 39% of the Medicaid population suffers from depressive disorders (Thomas et al., 2005; Berg et al, 2014). Yet, the recent literature on them is severely limited and dated. A search of the Pubmed database for articles on 'Medicaid', 'depression', and 'adults' terms returned 166 peer-reviewed journal articles after January 1, 2012, with many of those articles based on data from more than several years before the publication dates. The current study fills in the lacking evidence-base on innovative programs targeting adult Medicaid recipients with depression.

The third strength of the current study is the examination of health service use changes through participation in a collaborative care program. Most often depression severity change is the primary outcome addressed in studies of collaborative care programs, however in this study both were included. Even though collaborative care for depression programs were not designed to cut costs, the implication is that improved depression care would lead to overall health improvement. This association, however, has been rarely addressed in evaluative studies of collaborative care for depression in primary care programs. Moreover, the current study

examined aspects of the contacts between the behavioral health coaches and participants to determine if dose-response and medium of contact effects exists. These findings contribute to the knowledge base on effective programming with collaborative care for depression in primary care interventions.

A fourth strength is the use of propensity score matching to identify a best-matched comparison group in situations where a control group is not possible. This often occurs in real-world settings where new programs are implemented throughout a system before they have been studied within a smaller pilot group to assess effectiveness, even if these programs are evidence-based. The researcher must 'retrospectively' identify a comparison group and propensity score matching uses logistic regression methods to reduce or eliminate the effects of confounding variables (Austin, 2011). With observational studies such as the current study, systematic differences in baseline characteristics of participants are accounted for through use of propensity score matching, similar to randomized controlled trials. This method serves to balance the distribution of measured baseline covariates between the treated and untreated participants (Austin, 2011). Researchers must also be aware, there are several concerns when using propensity score matching. This includes the need to ensure identification of a comprehensive list of confounding variables related to the outcome(s) variables (Austin, 2011). The propensity score cannot account for unobserved covariates. The covariates must also not have missing data because it will reduce the sensitivity of the propensity score in identifying a match (Okoli, Sanders & Myles, 2014). Finally, the potential to include covariates related to treatment assignment and not outcome, thereby over-correcting the model, exists with the inclusion of covariates that are not relevant (Austin, 2011; Okoli, Sanders & Myles, 2014).

Finally, the current study utilized data from multiple geographical sites. Urban counties in different parts of the United States, MD, TN, and TX, were included. This allowed for variability in provider density and social determinants of health that begin to replicate the larger Medicaid population and strengthen the ability to generalize to similar urban geographic areas.

PRACTICAL AND POLICY IMPLICATIONS

There are a number of policy implications based on the findings from this study. Continued research focused on patients with depression in the Medicaid population is needed. Several findings in the current study contradict what is in the current literature. As noted previously, mental health services for the Medicaid population is not a well-studied area of research. More research is needed to understand if these findings are specific to this study population or if Medicaid patients in general have different utilization patterns from patients with employer-sponsored coverage or Medicare beneficiaries. Working with data from the Medicaid population can be difficult, given the available Medicaid data from CMS, the number of individual and community-level factors that influence findings, difficulty in obtaining follow up data, and Medicaid "churn." Medicaid churn refers to the gaps in health coverage beneficiaries experience as they lose or gain coverage depending on their income level. Shi & Stevens (2010) state "even when receiving care, they tend to have worse health outcomes than others" (p. 3). The magnitude and multifaceted nature of their health care needs, both at the individual and community level, make this a difficult group to effect meaningful change in health outcomes. However, they are an important group to study given their degree of vulnerability to poor health outcomes, particularly as Congress continues to debate over the future of Medicaid funding and the Affordable Care Act. The need for continued research with Medicaid populations continues.

The PHQ-9 is a self-administered assessment tool that generally takes three to five minutes to complete and score. The inclusion of a self-reported depression screening for all new patients with their primary care physicians is a relatively quick way to identify patients who may need additional behavioral health services but are too embarrassed to discuss or are unaware that they may have depression. Patients can also be asked to complete the PHQ-9 annually, as an additional form completed in the waiting area along other forms that confirm their current health insurance information, current medications, etc. As the current study has shown, 46% percent of intervention participants had an existing diagnosis of a depressive disorder. Yet 100% of the intervention participants in the study were assessed to be clinically depressed from the PHQ-9, revealing an under-diagnosis of depression and the capability to "catch" those in need of behavioral health services sooner. Connecting patients with a trained mental health case manager can ensure they are receiving their medications, as well as keeping up with both their behavioral health and physical health appointments. Improved disease management and identification of depression early on in order to prevent patients from reaching a more debilitating level can mitigate the $210.5 billion in U.S. economic lost each year (Greenberg et al., 2015).

The positive association between the number of contacts and improved depression symptomatology and the support for telephonic contacts suggest the need for collaborative care for depression programs to find ways to increase the number of contacts between BH coaches and the members through multiple approaches. Alternative ways to do outreach could include emails and text messaging, when in-person office contacts are not possible, as well as ways to keep patients engaged. Currently medical offices can send auto-texts to their patients to remind them of an upcoming appointment. Similar automation could be utilized that reminds patients to contact their behavioral health coaches with specific available dates and times to reach them.

All automation would also need to be compliant with HIPAA regulations as the need to protect personal health information (PHI) currently limits what information can be sent. Including more phone-based services for patients to interact with behavioral health providers was supported through the current study's findings. Most smart phones include cameras that video-conferencing or tele-health services may be another way to reach populations with barriers to coming in to an office. Many low-wage earners work in positions where their schedules may vary and getting to an appointment between 8 a.m. and 5 p.m. are difficult whereas meeting with a provider over a smart phone with video capabilities may be feasible during a work break or outside of clinic hours. From my participation in weekly program calls, it was clear that the BH coaches attempted to be as available as possible to the participants, however despite repeated attempts to follow up with their patients, the coaches noted challenges in maintaining patient engagement in the program.

Payers should allow integrated health care delivery reforms time to gain traction within the settings by recognizing a longer timeline may be needed before cost savings are realized. Providers and patients need more time to adjust to a change in how they provide services and referrals. Managed care companies using collaborative care programs must be aware that a longer implementation period and integration into the system is needed and that costs and use may increase in the first six months to a year but will lower over time. A similar pattern was seen among newly eligible Medicaid enrollees who gained coverage under the ACA's Medicaid expansion when comparing their initial enrollment spending to their spending after being enrolled for a period of time (Jacobs, Kenney & Selden, 2017). Patients in these programs have numerous long-standing financial, medical, behavioral health, and social needs that often cannot

be turned around in six months or even one year but having that continuous, coordinated care can result in cost offsets after the initial period.

Chronic illness severity, comorbidity, and knowledge of conditions were significantly associated with the outcomes measured. As the U.S. population continues to age and suffer from multiple medical conditions, often associated with or leading to depressive disorders, focusing on healthier life-styles will become vital to improving quality of life. Proper self-management of one's health is also important given physician and nursing shortages in years to come as the baby-boomer generation is retiring and will require more health care services. Over recent years the health field has become more aware of the connection between mental health, physical health, and mortality, providing those who work with patients with behavioral health disorders opportunities to engage in education and interventions in their daily practice that can lead to healthier lifestyle choices (Scott & Happell, 2011). Mental health specialists working in integrated primary care practices should assess where in the continuum of readiness to change their patients are at in order to meet them at that stage as stage-matched interventions have been found to result in higher adoption of healthy behaviors (Levesque et al., 2011).

This study also points to the need for the medical profession to focus on the behavioral health needs of all patients, not only with primary care physicians, but with all medical specialties. Medical education has always been firmly rooted in the disease model with most pre-clinical education lacking any significant patient contact much less their psychosocial or social needs, despite efforts by the Institute of Medicine and American Association of Medical Colleges calling for improved psychosocial and mental health training throughout medical school and residency (Smith et al., 2014). Chin et al. (2000) report that in a national study of internal medicine residents the median number of hours spent on psychosocial training is 17 per

year. As an example of what's being described as a major change in medical training, the medical school curriculum at Michigan State University has recently implemented a 3-year curriculum for internal medicine residents based on the biopsychosocial model. The new curriculum aims to train their medical residents to be equally competent in working with common psychosocial and mental health problems as they are with medical problems (Smith et al, 2014).

As the health care field continues to grow and allied health professionals move into more front-line roles with patients, clearer definitions of what care coordination services are and an understanding of what type of training and which key disciplines need to be present in any care coordination team, are required to effectively manage patients with multiple chronic conditions. The terms of 'care coordination',' case management', and 'shared care' are used interchangeably in the literature and in the health field, often causing confusion to patients and providers. The general concept of coordinated care, which may include services such as making appointments, checking in with patients, addressing insurance coverage, and conducting assessments, needs to be better defined if it is truly to be an improvement over the long-standing case management services which have traditionally been conducted by nurses. Perhaps some aspects of care coordination can be relegated to non-master's level workers, in order to reduce overall staffing costs. Other care coordination services requiring medical training and knowledge of clinical guidelines can be reserved for master's level social workers or RN with specialized training/certification in order to keep caseloads manageable.

Finally, the need to expand Medicaid provider networks, particularly for behavioral health, is evident. Although the rate of Medicaid acceptance within the three health plans was not included in the analysis, the low participation rates of providers in Medicaid plans is often

cited in the literature. In 2013, 68.9% of office-based providers accepted new Medicaid patients (Hing, Decker & Jamoom, 2015). This is primarily due to the lower reimbursement rates compared to Medicare and private insurance. Exacerbating the issue even more is the fact that the percentage of office-based psychiatrists who participate in insurance networks is the lowest of all physician specialties (Bishop et al., 2014). Medicaid acceptance rates in 2009-10 for psychiatrists compared to all other physicians was 43.1% versus 73.0%., making access to mental health services even more difficult for this population (Bishop et al., 2014). The challenges facing people on Medicaid have been enumerated throughout this study, with limited access to providers being a key barrier. It stands to reason that expanding the number of providers by financial incentives to accept more Medicaid patients would improve access and their health outcomes.

FUTURE RESEARCH

Given the number of limitations in this study, future research should focus on attempts at addressing those limitations. These include larger sample sizes, longer follow up period, focus on the influence of substance/alcohol abuse, and the inclusion of medication adherence data. There are also other analyses that could be conducted. For example, a Cox hazard regression can be conducted to determine length of time it takes to reach depression remission or reach a 10% reduction in emergency department visits after enrolling in a CC program. In their study of a collaborative care for depression program offering integrated care for safety-net patients, the Washington State Mental Health Integration Program, Unutzer et al., (2012) found that participants achieved desired clinical improvement in their depression at a faster rate after the program was introduced compared to before program implementation. The median time elapsed

to achieve a 50% reduction of a PHQ-9 score less than 10 dropped from 64 weeks to 25 weeks (Unutzer et al., 2012).

Expand the number of sites beyond three to increase the number of participants. With larger samples, additional analyses should be conducted with specific types of chronic illnesses as a predictor. Research regarding the type of physical chronic conditions, e.g., diabetes, cardiovascular disease, HIV/AIDS, etc. and the relationship with health service utilization rates could be conducted. Furthermore, inclusion of health plans in states with and without Medicaid expansion would also be an important factor to consider when choosing study sites. This would provide more analysis of the effects Medicaid expansion has had on health service use and costs on patients with behavioral health disorders.

As the health field moves away from fee for service and toward value-based health care financing that tie provider payment to quality and patient outcomes, future research should include a cost benefit analysis. Financial data were not available for analysis in the current study. However, the investments made within the Medicaid budget to focus on medical homes and care integration appear to be paying off. Fillmore et al. (2014) analyzed financial data from Medicaid claims of non-elderly Medicaid patients with disabilities from January 2007 through third quarter 2011. They received care through a statewide person-centered medical home initiative in North Carolina, Community Care of North Carolina. Their analysis found that large-scale care management programs result in significant savings, $184,064,611 over nearly five years, especially among persons with multiple chronic conditions (Fillmore at el., 2014). Analysis of these types of Medicaid programs should make a point to include findings on the economic impact involved in transforming primary care into medical homes with enhanced care coordination for people with behavioral health and chronic physical health conditions.

Comparison studies of the structural integration of collaborative care programs are needed. This would provide additional information on the benefits and barriers of having the BHC fully integrated into the primary care clinic and their funding is with the healthcare organization compared to where they are co-located and they are funded through a participating health plan. This creates logistical problems when the BHCs are not seamlessly part of the healthcare team in terms of reimbursement, billing, confidentiality and access to electronic health records, and hand-offs between the medical staff and the behavioral health coaches. These limitations may have affected the amount of benefit received from the collaborative care program.

Additional research should continue to focus on specific subgroups of Medicaid patients with depression. Furthermore, focusing specific subgroups of Medicaid patients, such as disability patients, or 'super utilizers' of acute care, may allow more focus on Medicaid recipients who may require higher health service needs and are more costly. These patients are often more likely to be on Medicaid for an extended coverage period which makes it easier to identify long-term changes in clinical outcomes and health services utilization. The current study did not target high utilizers due to the limited sample size, but analysis of patients with high ED use and/or high inpatient readmissions may have resulted in significant group differences in health service use between collaborative care and TAU patients.

Also, research focused on collaborative care programs and Medicaid patients with SUD/depressive disorders is greatly needed. Since the 1980s, the high prevalence of the comorbidity of drug abuse and mental health has been documented in national population surveys, revealing that people with mood or anxiety disorders are twice as likely to suffer from substance use disorders, and vice versa, compared to the general population (NIDA, 2010).

Results from the 2015 National Survey on Drug Use and Health indicate that 18.6% of adults age 18 and older who had any mental illness in the past year also met the criteria for an SUD (Center for Behavioral Health Statistics and Quality, 2016). As noted earlier, in the current study the two study groups differed in SUD/Alcohol use diagnosed at index visit. The collaborative care for depression group had a higher number of patients diagnosed with an SUD/Alcohol disorder. Although it was not an inclusion criteria to participate in the collaborative care for depression program, these symptoms were screened for and addressed during their follow up contacts with their coaches. Propensity score matching was not able to reduce the bias contributed from having a SUD diagnosis at index visit. Additional analysis of billed procedural codes is warranted to determine if the ED use increase by intervention participants in case management was driven by SUD services.

In general, intervention process characteristics need to be better understood to determine under what circumstances collaborative care programs can be most effectively implemented (APA, 2016). Programmatic guidelines such as the minimum number of contacts within a period of time needed, e.g., twice a week, as well as how much time should lapse between follow ups, should be identified specific to the population of interest to best focus staff resources. Additionally, the best medium by which to contact participants can determine resources needed, such as whether to provide cell phones to participants while they are part of the program to increase the ability to contact them.

Further research on the types of services and procedures being billed for at different stages (e.g., at 3 months, 6 months, one year, two years, three years, etc.) in collaborative care programs can further inform what case management strategies are needed to ensure adequate provider resources are available. The intervention is a pilot for identifying patients with

depression in a primary care setting, therefore many of the program's participants were most likely not receiving the specialized behavioral health services they needed. After enrolling in the program, the number of mental health procedures billed for did increase by 20 percent and for physical health services by 21 percent. Both groups utilized alcohol and drug services during the pre and post periods. The intervention group utilized slightly more psychotherapy services (pre use 16.1%, post use 18.6%) whereas the TAU group used more psychosocial rehab services (pre use 12.2%, post use 23.7%) in their outpatient behavioral health service needs. Case management was one of the top billed procedures within the outpatient physical health services for the TAU group; whereas in-home nursing care, therapeutic services, and in-hospital care for less than 24 hours were more often seen with the intervention group. These differences may point to the need for more acute clinical services with Medicaid participants when they first enter the program, and as their immediate behavioral health and physical health needs are addressed and brought under control, more links to community supports may be needed, as was seen with the TAU group. Being able to establish a general timeline of when certain types of services are needed could prove very helpful to collaborative care program managers and Medicaid care managers.

CONCLUSIONS

This study extends the health service field's evidence base on the effectiveness of programs that promote an integrated, coordinated, patient-centered approach. The collaborative care for depression program implemented with Medicaid patients was successful in decreasing depression severity. While that finding alone is not a novel contribution to the field of behavioral health and collaborative care models, the factors that led to that decrease provide additional insight into further developing these programs among Medicaid populations.

Decreases in depression severity among the program participants were associated with feeling that they had sufficient knowledge of their condition at their index enrollment visit as well as higher BH/medical provider density. Because only one Medicaid health plan was categorized as higher provider density, the Maryland plan, this may be a function of the coaches in the Maryland plan and/or the specific Medicaid services provided by that health plan rather than the number of providers in the area. A dose response effect was found in which increased coach-patient contacts was significantly associated with decreased depression severity. Patients who reached a clinical response, which is a 50% reduction in severity, had almost 50% more follow up contacts with their coaches compared to those who did not achieve a clinical response. Post-hoc analyses revealed that coaches in the MD health plan had more patient follow ups than in TX and TN.

There were unexpected findings including younger participants having a higher likelihood of increased ED visits compared to older participants; and case management being associated increased ED visits. Furthermore, this study found that telephone follow up contacts between coaches and participants are comparable in outcomes to in-person contacts, and more desirable than equal FTF/telephone contacts. These findings highlight the need for frequent and continuous monitoring by their primary care providers, which include the Behavioral Health coaches, and in ways that address the unique and challenging circumstances of Medicaid patients that inhibit timely access to health care. This puts the patient back in patient-centered care.

Gelberg, Andersen & Leake's (2000) Behavioral Model for Vulnerable Populations is a fitting framework to begin establishing a consistent way to evaluate collaborative care programs with Medicaid populations. Individual and community-level characteristics were identified as predictors of health service use. These include pregnancy, illness severity, prior health service

use, prior case management, diagnosed depression, and characteristics of the state's Medicaid health plan. These predictors are primarily variables characterized as 'enabling' and 'need' variables from a health service utilization framework. Knowing what specific factors influence service used among Medicaid populations helps healthcare professionals and program directors adapt how care coordination models are implemented in primary care to be more effective. In addition, these findings identify predictors to include in future predictive models estimating health service use with a Medicaid population. Over the last 20 years the evidence base on collaborative care programs for depression within primary care has established this as a viable option for treating depression. What the current study attempted to discover is their effects on health service use and the connection between depression management and health service use. The study's findings shed light on these aspects of collaborative care programs, particularly with a Medicaid population, but further research is needed to better understand if reductions in the use of acute services such as hospitalizations and ED visits are resulting from these enhancements to case management in primary care.

REFERENCES

Aday, L. & Awe, W. (1997). Health Services Utilization Model. In *Handbook of Health Behavior Research, Vol. 1. Determinants of Health Behavior: Personal and Social,* edited by D. Gochman. New York: Plenum Publishing Co.

Aday, L. (2001). *At Risk in America: The Health and Health Care Needs of Vulnerable Populations in the United States*. San Francisco, CA: Jossey-Bass Publishers.

Advancing Integrated Mental Health Solutions [AIMS Center]. (2015). *Collaborative Care: Evidence base.* Retrieved from http://aims.uw.edu/collaborative-care/evidence-base

Advancing Integrated Mental Health Solutions [AIMS Center]. (2015). *PHQ-9 Depression Scale.* Retrieved from http://aims.uw.edu/resource-library/phq-9-depression-scale

Afendulis, C.C., Hatfield, L.A., Landon, B.E., Gruber, J., Landrum, M.B., Mechanic, R.B., Zinner, D.E. & Chernew, M.C. (2017). Early impact of CareFirst's patient-centered medical home with strong financial incentives. *Health Affairs, 36(3),* 468-475.

AIMS Center. University of Washington. (2014). Collaborative Care. Retrieved from http://aims.uw.edu/collaborative-care

Alegria, M., Jackson, J.S., Kessler, R.C. & Takeuchi, D. (2003*). National Comorbidity Survey Replication (NCS-R), 2001-2003*. Ann Arbor: Interuniversity Consortium for Political and Social Research.

Alegria, M., Chatterji, P., Wells, K, et al. (2008). Disparity in depression treatment among racial and ethnic minority populations in the United States. *Psychiatric Services, 59*, 1264–1272.

American Psychiatric Association. Academy of Psychosomatic Medicine. (2016). *Report on dissemination of integrated care within adult primary care settings: The Collaborative*

Care Model. Arlington, VA: APA. Retrieved from http://www.integration.samhsa.gov/integrated-care-models/APA-APM-Dissemination-Integrated-Care-Report.pdf

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Retrieved from http://dsm.psychiatryonline.org/book.aspx?bookid=556

Anand, S. & Baernighausen, T. (2004). Human resources and health outcomes: Cross-country econometric study. *The Lancet, 364*, 1603-1609.

Andersen, R. (1968). *A behavioral model of families' use of health services.* Center for Health Administration Studies Research Series. Chicago, IL: University of Chicago Press.

Andersen, R. (1995). Revisiting the behavioral model and access to medical care: Does it matter? *Journal of Health and Social Behavior, 36,* 1-10.

Anderson, R.J., Freedland, K.E., Clouse, R.E., Lustman, P.J. (2001). The prevalence of comorbid depression in adults with diabetes: a meta-analysis. *Diabetes Care, 24*:1069–1078.

Andersen, R. & Newman, J.F. (2005). Societal and individual determinants of medical care utilization in the United States. *The Milibank Quarterly, 83(4),* 1-28.

Anderson, G. Robert Wood Johnson Foundation (2010). *Chronic care: Making the case for ongoing care.* Princeton: Robert Wood Johnson Foundation

Andrews, C., Grogan, C.M., Brennan, M. & Pollack, H.A. (2015). Lessons from Medicaid's divergent paths on mental health and addiction services. *Health Affairs,34(7),* 1131-1138. doi: 10.1377/hlthaff.2015.0151

Angstman, K.B., Rohrer, J.E. & Rasmussen, N.H. (2012). PHQ-9 response curve: rate of improvement for depression treatment with collaborative care management. *Journal of Primary Care & Community Health, 3(3),* 155– 158. doi: 10.1177/2150131911423824

Angstman, K. B., Pietruszewski, P., Rasmussen, N. H., Wilkinson, J. M., & Katzelnick, D. J. (2012). Depression remission after six months of collaborative care management: role of initial severity of depression in outcome. *Mental Health In Family Medicine, 9*(2), 99-106.

Archer, J., Bower, P., Gilbody, S., Lovell, K., Richards, D., Gask, L., Dickens, C. & Coventry, P. (2012). Collaborative care for depression and anxiety problems. *Cochrane Database Systems Review.* doi: 10.1002/14651858.CD006525.pub

Austin, P. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate Behavioral Research, 46(3), 399-424. doi: 10.1080/00273171.2011.568786

Baicker, K., Taubman, S., Allen, H., Bernstein, M., Gruber, J. , Newhouse, J.P.,…Finkelstein, A. (2013). The Oregon experiment – Medicaid's effects on clinical outcomes. *New England Journal of Medicine, 368(18),* 1713-1722.

Benjamin, R. (2010). Multiple chronic conditions: A public health challenge. Surgeon General's Perspectives. *Public Health Reports, 125,* 626-627.

Berg, G., Donnelly, S., Warnick, K., Medina, W. & Miller, M. (2014). Dose-response effects for depression and schizophrenia management on hospital utilization in Illinois Medicaid: a multivariate regression analysis. *BMC Health Services Research, 14,* 288. doi: 10.1186/1472-6963-14-288

Berwick, D.M., Nolan, T.W. & Whittington, J. (2008). The triple aim: Care, health and cost. *Health Affairs, 27(3),* 759-769.

Bishop, T.F., Press, M.J. Keyhani, S. & Pincus, H.A. (2014). Acceptance of insurance by psychiatrists and the implications for access to mental health care. *JAMA Psychiatry, 71(2),* 176-181.

Blackwell, D.L., Lucas, J.W. & Clarke, T.C. (2014). *Summary health statistics for U.S. adults: National health interview survey, 2012.* National Center for Health Statistics. Vital Health Stat, 10(260).

Blewett, L., Johnson, P.J., Lee, B. & Scal, P.B. (2008). When a usual source of care and usual provider matter: Adult prevention and screening services. *Journal of General Internal Medicine, 23(9),* 1354-1360.

Bridges, A., Andrews, R. Villalobos, B.T., Pastrana, F., Cavell, T. & Gomez (2014). Does integrated behavioral health care reduce mental health disparities for Latinos? Initial findings. *Journal of Latina/o Psychology, 2(1),* 37-53.

Broderick, A. & Haque, F. (2015, May). *Mobile health and patient engagement in the safety net: A survey of community health centers and clinics. Pub. 1813, vol. 9.* Washington, D.C.: Commonwealth Fund. Retrieved from http://www.commonwealthfund.org/~/media/files/publications/issue-brief/2015/may/1813_broderick_mobile_hlt_patient_engagement_ib.pdf

Campbell-Sills, L., Stein, M.B., Craske, M.G. …Roy-Byrne, P. (2013). Effects of medical comorbidity on anxiety treatment outcomes in primary care. *Psychosomatic Medicine, 75(8):*713-20. doi: 10.1097/PSY.0b013e31829def5

Carney, C.P. & Jones, L.E. (2006). Medical comorbidity in women and men with bipolar disorders: A population-based controlled study. *Psychosomatic Medicine, 68(5),* 684-691.

Carney, C.P., Jones, L. & Woolson, R.F. (2006). Medical comorbidity in women and men with schizophrenia: A population-based controlled study. *Journal of General Internal Medicine, 21(11),* 1133-1137.

Center for Behavioral Health Statistics and Quality. (2016). *Key substance use and mental health indicators in the United States: Results from the 2015 National Survey on Drug Use and Health* (HHS Publication No. SMA 16-4984, NSDUH Series H-51). Retrieved from http://www.samhsa.gov/data/

Centers for Disease Control [CDC]. (2009). *Chronic diseases: The power to prevent, the call to control. At a glance 2009.* National Center for Chronic Disease Prevention and Health Promotion.

Centers for Disease Control [CDC]. (2010). Current depression among adults – United States, 2006 and 2008. *Morbidity and Mortality Weekly Report (Erratum), October 1, 2010, 59(38)*:1229-1235.

Centers for Disease Control [CDC]. (2013). *CDC Report: Mental Illness Surveillance Among U.S. Adults.* Atlanta: Centers for Disease Control. Retrieved from http://www.cdc.gov/mentalhealthsurveillance/fact_sheet.html

Centers for Disease Control [CDC]. (2014, February). Workplace health promotion. Depression. Retrieved from http://www.cdc.gov/workplacehealthpromotion/evaluation/topics/depression.html

Centers for Medicaid & Medicare Services [CMS]. (2007, November 30). U.S. Department of Health & Human Services. *Medicaid definition of covered case management services clarified.* Retrieved from https://www.cms.gov/Newsroom/MediaReleaseDatabase/Fact-sheets/2007-Fact-sheets-items/2007-11-30.html

Centers for Medicaid & Medicare Services [CMS]. (2013). U.S. Department of Health & Human Services. 2013 Actuarial report on the financial outlook for Medicaid. Rockville, MD: DHHS.

Centers for Medicaid & Medicare Services [CMS]. (2014, January 16). CMCS informational bulletin. Baltimore, MD: DHHS.

Chang, E., Wells, K.B., Gilmore, J., Tang, L., Morgan, A.U., Sanders, S. & Chung, B. (2015). Comorbid depression and substance abuse among safety-net clients in Los Angeles: A community participatory study. *Psychiatric Services, 66(3),* 285-294. doi:10.1176/appi.ps.201300318

Charlson, M.E., Pompei, P., Ales, K.L. & MacKenzie, C.R. (1987). A new method of classifying prognostic comorbidity in longitudinal studies: development and validation, *Journal of Chronic Diseases, 40(5),* 373-83.

Chartier, M., Walker, J. & Naimark, B. (2007). Childhood abuse, adult health, and health care utilization: Results from a representative community sample. *American Journal of Epidemiology, 165(9*), 1031-1038.

Chen, J.J., Caller, T.A., Mecchella, J.N., Thakur, D.S., Homa, K., Finn, C.T.,…Jobst, B.C. (2014). Reducing severity of comorbid psychiatric symptoms in an epilepsy clinic using a colocation model: Results of a pilot intervention. *Epilepsy Behavior, 39,* 92-6. doi: 10.1016/j.yebeh.2014.07.015. Epub 2014 Sep 18.

Chin, H.P., Guillermo, G., Prakken, S., Eisendrath, S. (2000). Psychiatric training in primary care medicine residency program: A national survey. *Psychosomatics, 41,* 412-7.

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112(1),* 155-159.

Cook, B.L., Trinh, N., Zhihui, L., Hou, S., Progovac, A.M. (2017). Trends in racial-ethnic disparities in access to mental health care, 2004-2012. Psychiatric Services, 68(1), 9-16. doi: 10.1176/appi.ps.201500453

Cooper, R.A. (2008). States with more physicians have better quality health care. *Health Affairs, 28(1),* w91-w102. Retrieved from http://content.healthaffairs.org/content/28/1/w91.full.html

Cummings, J.R., Wen, H., Ko, M., & Druss, B.G. (2013). Geography and the Medical mental health care infrastructure: Implications for health care reform. *JAMA Psychiatry, 70(10),* 1084-1090. doi: 10.1001/jamapsychiatry.2013.377

De Hert, M., Correll, C., Bobes, J., Cetkovich-Bakmas, M., Cohen, D., Asai, I., …& Leucht, S. (2011). Physical illness in patients with severe mental disorders. I. Prevalence, impact of medications and disparities in health care. *World Psychiatry, 10,* 52-77.

Department of Health & Human Services. Centers for Medicare & Medicaid Services [CMS]. (2010, November). *Re: Health Homes for enrollees with chronic conditions.* [Letter to State Medicaid Directors]. Retrieved from http://downloads.cms.gov/cmsgov/archived-downloads/SMDL/downloads/SMD10024.pdf

Department of Health and Mental Hygiene. (n.d.). *Medicaid eligibility and benefits*. Retrieved from https://mmcp.dhmh.maryland.gov/pages/medicaid-eligibility-and-benefits.aspx

Dejean, D., Giacomini, M., Vanstone, M. & Brundisini, F. (2013, September). Patient experiences of depression and anxiety with chronic disease: a systematic review and qualitative meta-synthesis. *Ontario Health Technology Assessment Series, 13(16*), 1-33.

Druss, B. G. & Walker, E.R. (2011, Feb.). *Mental disorders and medical comorbidity.* Research synthesis report No. 21. Princeton, NJ: The Robert Wood Johnson Foundation. Retrieved from https://www.integration.samhsa.gov/workforce/mental_disorders_and_medical_comorbidity.pdf

DuGoff, E., Dy, S., Giovannetti, E., Leff, B., Boyd, C., (2013). Setting standards at the forefront of delivery system reform: aligning care coordination quality measures for multiple chronic conditions. *Journal for Healthcare Quality, 35(5),* 58-69.

Egede, L.E. (2007). Major depression in individuals with chronic medical disorders: Prevalence, correlates and association with health resource utilization, lost productivity and functional disabilitiy. *General Hospital Psychiatry, 29(5),* 409-416.

Ellis, C., Grubaugh, A.L. & Egede, L.E. (2012). The association between major depression, health behaviors, and quality of life in adults with stroke. *International Journal of Stroke, 7(7),* 536-43. doi: 10.1111/j.1747-4949.2011.00708.x.

Engel, G. (1977). The Need for a New Medical Model: A Challenge for Biomedicine. *Science, 196(4286),* 129–36. doi:10.1126/science.847460. Retrieved from http://dx.doi.org/doi:10.1126/science.847460.

Evans, D.L., Charney, D.S., Lewis, L., Golden, R.N., Gorman, J.M., Krishnan, K.,…Valva, W.J. (2005). Mood disorders in the medically ill: Scientific review and recommendations. *Biologic Psychiatry, 58(3*), 175-189.

Egede, L.E. (2007). Major depression in individuals with chronic medical disorders: prevalence, correlates and association with health resource utilization, lost productivity and functional disability, *General Hospital Psychiatry , 29(5),* 409 – 416.

Engel, G. (1977). The Need for a New Medical Model: A Challenge for Biomedicine. *Science, 196(4286),* 129–36. doi:10.1126/science.847460. Retrieved from http://dx.doi.org/doi:10.1126/science.847460.

Evans, D.L., Charney, D.S., Lewis, L., Golden, R.N., Gorman, J.M., Krishnan, K.,…Valva, W.J. (2005). Mood disorders in the medically ill: Scientific review and recommendations. *Biologic Psychiatry, 58(3*), 175-189.

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175-191.

Field, A. (2103). *Discovering statistics using IBM SPSS statistics*. 4th edition. Thousand Oaks, CA: SAGE Publications Inc.

Fillmore, H. Dubard, A., Ritter, G.A. & Jackson, C.T. (2013). Health care savings with the patient-centered medical home: Community care of North Carolina's experience, *Population Health Management, 17,* 141-148.

Frank, R.G., Goldman, H.H., & Hogan, M. (2003). Medicaid and Mental Health: Be Careful What You Ask for. *Health Affairs, 22(1):* 101–13.

Funk, M. & Ivbijaro, G. WHO. (2008). *Integrating mental health into primary care: A global perspective.* Geneva, Switzerland: WHO Press.

Gelberg, L., Andersen, R.M. & Leake, B. (2000). The behavioral model for vulnerable populations: application to medical care use and outcomes for homeless people. *Health Services Research, 34(6)*: 1273-1302.

Gellis, Z.D., Kenaley, B.L. & Have, T.T. (2014, March). Integrated telehealth care for chronic illness and depression in geriatric home care patients: The integrated telehealth education and activation of mood (I-TEAM) study. *American Geriatrics Society, 62(5),* 889-895.

Gilbody, S., Bower, P., Fletcher, J., Richards, D. & Sutton, A.J. (2006). Collaborative care for depression: a cumulative meta-analysis and review of longer-term outcomes. *Archives of Internal Medicine, 166(21)*, 2314-2321.

Gallimore, C.E., Schreiter, E.Z. & Margolis, A.R. (2016). Pharmacist medication reviews to improve safety monitoring in primary care patients. *Families, Systems & Health, 34(2),* 104-113. doi: dx.doi.org/10.1037.fsh0000185

Gindi, R., Black, L.I & Cohen, R.A. U.S. Department of Health and Human Services. (2016, February 18). Reasons for emergency room use among U.S. adults aged 18-64: A national health interview survey, 2013 and 2014. *National Health Statistics Report. Number 90.* Retrieved from https://www.cdc.gov/nchs/data/nhsr/nhsr090.pdf

Gitlin, L., Szanton, S.L., Huang, J., Roth, D.L. (2014). Factors mediating the effects of a depression intervention on functional disability in older African Americans. *Journal of the American Geriatrics Society, 62(12*), 2280-2287.

Greenberg, P. E., Fournier, A. A., Sisitsky, T., Pike, C. T., & Kessler, R. C. (2015). The economic burden of adults with major depressive disorder in the United States (2005 and 2010). *Journal of Clinical Psychiatry, 76,* 155–162. doi: 10.4088/JCP.14m09298

Goodell, S., Druss, B.G. & Walker, E.R. (2011, February). Mental Disorders and medical comorbidity. (Policy Brief No. 21). Retrieved from http://www.rwjf.org/content/dam/farm/reports/issue_briefs/2011/rwjf69438

Government Accountability Office. (2011). *Most physicians serve covered children but have difficulty referring them for specialty care* (GAO Publication No. 11-624). Washington, DC: Author.

Hamar, B., Wells, A., Gandy, W., Bradley, C., Coberley, C., Pope, J.E. & Rula, E.Y. (2011). The impact of proactive chronic care management on hospital admission in a German senior population. *Population Health Management, Suppl 1: S29-33*. doi: 10.1089/pop.2010.0067.

Hampton, M.D., Chafetz, L. & White, M.C. (2010). Exploring the impact of race on mental health service utilization among African Americans and whites with severe mental illness. *Journal of the American Psychiatric Nurses Association, 16(2*), 78-88.

Hendrie, H.C., Lindgren, D., Hay, D.P., Lane, K.A.,… Callahan, C.M. (2013). Comorbidity profile and healthcare utilization in elderly patients with serious mental illnesses. *American Journal of Geriatric Psychiatry, 21(12*), 1267-1276.

Heslin, K., Andersen, R.M. & Gelberg, L., (2003). Case management and access to services for homeless women. *Journal of Health Care for the Poor and Underserved, 14(*1), 34-51.

Huang, H., Ya-Fen, C., Bauer, A., Joji, S., Wayne, K. … et al. (2013). Specialty behavioral health service use among chronically ill Medicare Advantage patients with substance use problems. *Psychosomatics, 54(6),* 54-551.

Hunkeler, E.M., Katon, W., Tang, L., . . . Unutzer, J. (2006). Long term outcomes from the IMPACT randomized trial for depressed elderly patients in primary care. *British Medical Journal, 332.* doi: http://dx.doi.org/10.1136/bmj.38683.710255.BE

Huffman, J.C., Niazi, S.K., Rundell, J.R., Sharpe, M., & Katon, W.J. (2014). Essential articles on collaborative care models for the treatment of psychiatric disorders in medical settings: A publication by the Academy of Psychosomatic Medicine Research and Evidence-based Practice Committee. *Psychosomatics, 55,* 109-122.

Hunkeler, E.M., Katon, W., Tang, L., Williams, J.W., Kroenke, K., Lin, E.H., Harpole, L.H., Arean, P., Levine, S., Grypma, L.M., Hargreaves, W.A. & Unutzer, J. (2006). Long term outcomes from the IMPACT randomized trial for depressed elderly patients in primary care. *British Medical Journal, 332(7536),* 259-263. doi: http://dx.doi.org/10.1136/bmj.38683.710255.BE

IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.

Institute for Clinical Systems Improvement. (2008). The DIAMOND initiative: Depression improvement across Minnesota, offering a new direction. Bloomington, MN: ICSI. Retrieved from http://www.integration.samhsa.gov/images/res/DIAMONDWhitePaper200807211.pdf

Institute of Medicine. (2001). *Crossing the quality chasm: a new health system for the 21st century*. Washington, D.C.: National Academies Press.

Jacob, V., Chattopadhyay, S., Sipe, T., Thota, A., Byard, G., & Chapman, D. (2012). Economics of collaborative care for management of depressive disorders: A community guide systematic review, *American Journal of Prevention Medicine, 42(5),* 39 –549.

Jeeva, F., Dickens, C., Coventry, P., Bundy, C., & Davies, L. (2013). Is treatment of depression cost-effective in people with diabetes? A systematic review of the economic evidence. *International Journal of Technology Assessment in Health Care, 29(4),* 384–391.

Jiang, H. & Wier, L. (2010). Healthcare Cost and Utilization Project. All-cause hospital readmissions among non-elderly Medicaid patients, 2007. Washington, D.C.: Agency for Healthcare Research and Quality.

Jacob, V., Chattopadhyay, S., Sipe, T., Thota, A., Byard, G. & Chapman, D. (2012). Economics of collaborative care for management of depressive disorders: A community guide systematic review, *American Journal of Prevention Medicine, 42(5),* 539 –549.

Jacobs, P.D., Kenney, G.M. & Selden, T.M. (2017). Newly eligible enrollees in Medicaid spend less and use less care those those previously eligible. *Health Affairs, 36(9),* 1637-1651. doi:10.1377/hlthaff.2017.0252

Jaglal, S. B., Guilcher, S. T., Hawker, G., Lou, W., Salbach, N. M., Manno, M., & Zwarenstein, M. (2014). Impact of a chronic disease self-management program on health care utilization in rural communities: a retrospective cohort study using linked administrative data. *BMC Health Services Research, 14(1),* 1-14. doi:10.1186/1472-6963-14-198

Jiang, H. & Wier, L. (2010). *Healthcare Cost and Utilization Project. All-cause hospital readmissions among non-elderly Medicaid patients, 2007.* Washington, D.C.: Agency for Healthcare Research and Quality.

Johnson, D. (2013). *Play book for PC-INSITE: How to guide.* Unpublished manuscript. Behavioral Health Department. Amerigroup, Virginia Beach, VA.

Johnson, D. (2014, October). *Primary Care-Integrating Screening, Identification, Treatment, & Evaluation of Depression/SUD. Interim outcomes report*. Unpublished manuscript. Behavioral Health Department, Amerigroup, Virginia Beach, VA.

Joo, J. Y. (2014). Community-Based Case Management, Hospital Utilization, and Patient-Focused Outcomes in Medicare Beneficiaries. *Western Journal Of Nursing Research, 36(6),* 825-844. doi:10.1177/0193945913514140

Kaiser Permanente Care Management Institute. (2012, June). Diagnosis and treatment of depression in adults: 2012 clinical practice guideline. Oakland, CA: Kaiser Permanente Care Management Institute.

Kangovi, S., Grande, D., Meehan, P., Mitra, N., Shannon, R. & Long, J.A. (2012). Perceptions of readmitted patients on the transition from hospital to home. Journal of Hospital Medicine, 7(9):709-12. doi: 10.1002/jhm.1966

Katon, W. & Schulberg, H. (1992). Epidemiology of depression in primary care. *General Hospital Psychiatry*, *14*, 237–247.

Katon, W., Von Korff, M., Lin, E., Simon, G., Ludman, E., Russo, J. . . Bush, T. (2004). The Pathways study: a randomized trial of collaborative care in patients with diabetes and depression. *Archives of General Psychiatry, 61(10);* 1042-1049. doi:10.1001/archpsyc.61.10.1042

Katon. W., Schoenbaum, M., Fan M., Callahan, C, Williams, J., Hunkeler, E,… Unützer, J. (2005). Cost-effectiveness of improving primary care treatment of late-life depression. *Archives of General Psychiatry, 62(12):*1313-1320.

Katon, W., Russo, J.E., Von Korff, M., Lin, E.H., Ludman, E., & Ciechanowski, P. (2008). Long-term effects on medical costs of improving depression outcomes in patients with depression and diabetes. *Diabetes Care, 31(6).*

Katon, W., Lin, E., von Korff, M., Ciechanowski, P., Ludman, E., Young, B.,…McCulloch, D. (2010). Collaborative care for patients with depression and chronic illnesses. *New England Journal of Medicine, 363,* 2611-2620.

Katon, W. (2012). Collaborative depression care models. *American Journal of Preventive Medicine, 42(5),* 550-552.

Katon, W., Unutzer, J., Wells, K., & Jones, L. (2010). Collaborative depression care: History, evolution and ways to enhance dissemination and sustainability. *General Hospital Psychiatry, 32(5),* 456-64.

Katon, W., Lin, W., VonKorff, M. , . . . McCulloch, D. (2010). Collaborative care for patients with depression and chronic illnesses. *New England Journal of Medicine, 363(27),* 2611-20. doi: 10.1056/NEJMoa1003955

Katon, W., Russo, J., Reed, S.D., Croicu, C., Ludman, E., LaRocco, A. & Melville, J. (2015). A randomized trial of collaborative depression care in obstetrics and gynecology clinics: Socioeconomic disadvantage and treatment response. *American Journal of Psychiatry, 172,* 32-40. doi:10.1176/appi.ajp.2014.14020258

Kautz, C., Mauch, D. & Smith, S.A. (2008). *A reimbursement of mental health services in primary care settings (HHS Pub. No. SMA-08-4324).* Rockville, MD: Center for Mental Health Services, Substance Abuse and Mental Health Services Administration.

Kerlinger, F. N. & Lee, H.B. *Foundations of behavioral research.* Fourth Ed. Belmont, CA: Cengage Learning.

Kessler, R. (2012). Mental health care treatment initiation when mental health services are incorporated into primary care practice. *Journal of American Board of Family Medicine, 25*, 255-259.

Kim, S. Michalopoulous, C., Kwong, R.M., Warren, A. & Manno, M.S. (2013). Telephone care management's effectiveness in coordinating care for Medicaid beneficiaries in managed care: A randomized controlled study. *HSR: Health Services Research, 48(5),* 1730-1749.

Kroenke, K., Spitzer, R.L., Williams, J.B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine, 16*, 606-613.

Kumar, A., Clark, S., Boudreaux, E. & Camargo, C. (2004). Multicenter study of depression among emergency department patients. *Academic Emergency Medicine, 11*, 1284-1289. Retrieved from http://onlinelibrary.wiley.com/doi/10.1197/j.aem.2004.08.053/epdf

Kyu-Tae, H., Eun-Cheol, P., Jae-Hyun, K., Sun Jung, K., & Sohee, P. (2014). Is marital status associated with quality of life? *Health & Quality Of Life* Outcomes, 12(1), 1-15. doi:10.1186/s12955-014-0109-0

Leininger, J., Friedsam, D., Voskuil, K. & DeLeire, T. (2014, October). Predicting high-need cases among new Medicaid enrollees. *The American Journal of Managed Care.* Retrieved from http://www.ajmc.com/publications/issue/2014/2014-vol20-n9/predicting-high-need-cases-among-new-medicaid-enrollees/1

Levesque, D., Van Marter, D.F., Schneider, R.J., Bauer, M.R., Goldberg, D.N., Prochaska, J.O. & Prochaska, J.M. (2011). Randomized trial of a computer-tailored intervention for patients with depression. *American Journal of Health Promotion, 26(2),* 77-89.

Lieberman, J.A. (2003). The use of antipsychotics in primary care. *Journal of Clinincal Psychiatry, 5 suppl 3*, 3-8.

Lindamer, L., Liu, L., Sommerfeld, D., Folsom, D., Hawthorne, W., Garcia, P., Aarons, G. & Jeste, D. (2012). Predisposing, enabling, and need factors associated with high service use in a public mental health system. *Administration and Policy in Mental Health, 39, 200-209.*

Lopez-Gonzalez L, Pickens GT, Washington R, et al. (2014, Oct.) *Characteristics of Medicaid and Uninsured Hospitalizations, 2012: Statistical Brief #182*. In Healthcare Cost and Utilization Project (HCUP) Statistical Briefs [Internet]. Rockville (MD): Agency for Health Care Policy and Research (US). Retrieved from http://www-ncbi-nlm-nih-gov.proxy.lib.odu.edu/books/NBK264167/

Lopez-Quintero, C., Berry, E.M. & Neumark, Y. (2009). Limited English proficiency is a barrier to receipt of advice about physical activity and diet among Hispanics with chronic diseases in the United States. *Journal of American Dietetic Association, 109(10*), 1769-74. doi: 10.1016/j.jada.2009.07.003.

Lustig, S.L. & Castel, L.D. (2017, August 18). Managed care companies should publish lessons learned from studying their own big data. [Web log comment]. Retrieved from http://healthaffairs.org/blog/2017/08/18/managed-care-companies-should-publish-lessons-learned-from-studying-their-own-big-data/

Mark, T., Tomic, K.S., Kowlessar, N., Chu, B.C., Vandivort-Warren, R. & Smith, S. (2013, April). Hospital readmission among medicaid patients with an index hospitalization for mental and/or substance use disorder. *Journal of Behavioral Health Services & Research, 40(2):* 207-21. doi: 10.1007/s11414-013-9323-5

Mark, T. L., Levit, K. R., & Buck, J. A. (2009). Psychotropic drug prescriptions by medical specialty. *Psychiatric Services, 60(9),* 1167.

Maryland Department of Health. (n.d.). Medicaid Provider Information. Retrieved from https://mmcp.health.maryland.gov/Pages/Provider-Information.aspx

McClellan, M., Kent, J., Beales, S.J., Cohen, S., Macdonnell, M., Thoumi, A.,…Darzi, A. Accountable care around the world: A framework to guide reform strategies. *Health Affairs, 33(9),* 1507-1515. doi: 10.1377/hlthaff.2014.0373

McCusker, J., Yaffe, M., Sussman, T., . . . Haggerty, J. (2012). Developing an evaluation framework for consumer-centered collaborative care of depression using input from stakeholders. *The Canadian Journal of Psychiatry, 58(3),* 160-168.

McGuire, T.G. & Miranda, J. (2008). New evidence regarding racial and ethnic disparities in mental health: policy implications. *Health Affairs, 27(2),* 393-403. doi: 10.1377/hlthaff.27.2.393.

Medicaid Health Plans of America [MHPA]. (n.d.). 2014-2015 *Best Practices Compendium: An Anthology of Medicaid managed care best practices,* pp. 65-66. Retrieved from http://www.seidman-says.com/assets/9publications_2014compendium.pdf

Melek, S. & Norris, D. (2008). *Chronic Conditions and Comorbid Psychological Disorders*. Seattle: Milliman.

McFeature, B. & Pierce, T.W. (2012). Primary care behavioral health consultation reduces depression levels among mood-disordered patients. *Journal of Health Disparities Research and Practice, 5(2),* 36-44.

MedlinePlus. U.S. National Library of Medicine. U.S. Department of Health and Human Services. (2015, March 16). *Major depression.* Retrieved from http://www.nlm.nih.gov/medlineplus/ency/article/000945.htm

Mehnert, A. & Koch, U. (2008). Psychological comorbidity and health-related quality of life and its association with awareness, utilization, and need for psychosocial support in a cancer register-based sample of long-term breast cancer survivors. *Journal of Psychosomatic Research, 64(4),* 383-91. doi: 10.1016/j.jpsychores.2007.12.005.

Melek, S. & Norris, D. (2008). *Chronic Conditions and Comorbid Psychological Disorders*. Seattle: Milliman.

Melfi, C.A., Croghan, T.W., Hanna, M.P. & Robinson, R.L. (2000). Racial variation in antidepressant treatment in a Medicaid population. *Journal of Clinical Psychiatry, 61(1),* 16-21.

Mericle, A.A., Ta Park, V.M., Holck, P., Arria, A.M. (2012). Prevalence, patterns, and correlates of co-occurring substance use and mental disorders in the United States: variations by race/ethnicity, *Compr Psychiatry, 53,* 657-665.

Miller, B.F., Kessler, R., Peek, C.J. & Kallenberg, G.A. (2011, July). *A national agenda for research in collaborative care: Papers from the Collaborative Care Research Network Research Development Conference*. AHRQ Publication No. 11-0067. Rockville, MD: Agency for Healthcare Research and Quality.

Miller, C. J., Grogan-Kaylor, A., Perron, B., Kilbourne, A.M., Woltmann, E. & Bauer, M. (2013). Collaborative chronic care models for mental health conditions. *Medical Care, 51(10),* 922-930.

Mitchell, A.J., Pereira, I.E., Yadegarfar, M., Pepereke, S., Mugadza, V., Stubbs, B. (2014). Breast cancer screening in women with mental illness: comparative meta-analysis of mammography uptake. *British Journal of Psychiatry, 205(6),* 428-35. doi: 10.1192/bjp.bp.114.147629.

Mohr, D.C, Ho, J., Duffecy, J., et al. (2010). Perceived barriers to psychological treatments and their relationship to depression. *Journal of Clinical Psychology,* 66(4), 394-409.

Mohr, D., Ho, J., Duffecy, J., Reifler, D., Sokol, L., Burns, M.N., … Siddique, J. (2012). Effect of telephone-administered vs face-to-face cognitive behavioral therapy on adherence to therapy and depression outcomes among primary care patients. *The Journal of the American Medical Association, 307(21),* 2278-2285. doi:10.1001/jama.2012.5588.

National Institute of Health [NIH]. (2009, June). *NIH Science of Behavior Change*. *Meeting Summary*. Bethesda, MD: NIH. Retrieved from https://commonfund.nih.gov/sites/default/files/SOBC_Meeting_Summary_2009.pdf

National Institute on Drug Abuse [NIDA]. (2010, September 1). *Comorbidity: Addiction and Other Mental Illnesses*. Retrieved from https://www.drugabuse.gov/publications/research-reports/comorbidity-addiction-other-mental-illnesses

National Institute on Drug Abuse [NIDA]. (2012, December). *Comorbidity*. *Brief Description.* Retrieved from http://www.drugabuse.gov/related-topics/comorbidity

New Hampshire Department of Health and Human Services [NHDHHS]. (2007, May). *Depression among New Hampshire Medicaid members.* Retrieved from http://www.dhhs.nh.gov/ombp/documents/depression.pdf

Niska, R., Bhuiya, F. & Xu, J. Centers for Disease Control and Prevention. (2010, August 6). National hospital ambulatory medical care survey: 2007 emergency department summary. *National Health Statistics Report, 26*.

Nutting, P., Gallagher, K., Riley, K., White, S., Dickinson, W.P., Korsen, N, & Dietrick, A. (2008). Care management for depression in Primary Care Practice: Findings from the RESPECT-Depression Trial.

Okoli, G.N., Sanders, R.D. & Myles, P. (2014). *Demystifying propensity scores. British Journal of Anaesthia, 112(1),* 13-15.

Olfson, M., Shea, S., Feder, A., Fuentes, M., Nomura, Y., Gameroff, M., & Weissman, M. M. (2000). Prevalence of anxiety, depression, and substance use disorders in an urban general medicine practice. *Archives of Family Medicine, 9*, 876-883.

Olfson, M. (2016). The rise of primary care physicians in the provision of U.S. mental health care. *Journal of Health Politics, Policy & Law, 41(4)*, 559-583.

Oxman, T.E., Dietrich, A.J., Schulberg, H.C. (2003). The depression care manager and mental health specialist as collaborators within primary care. The American *Journal of Geriatric Psychiatry, 11(5),* 507-516.

Paradise, J. (2015, March). Medicaid moving forward. (Issue brief.) Menlo Park, CA: The Henry J. Kaiser Family Foundation. Retrieved from http://kff.org/health-reform/issue-brief/medicaid-moving-forward/

Penkunas, M.J. & Hahn-Smith, S. (2015). An evaluation of IMPACT for the treatment of late-life depression in public mental health system. *The Journal of Behavioral Health Services & Research, 42(3),* 334-345. doi: 10.1007/s11414-013-9373-8.

Pfizer. (n.d.). *Instruction Manual: Instructions for Patient Health Questionnaire (PHQ) and GAD-7 Measures.* Retrieved from https://phqscreeners.pfizer.edrupalgardens.com/sites/g/files/g10016261/f/201412/instructions.pdf

Pirl, W. F., Beck, B. J., Safren, S. A., & Kim, H. (2001). A descriptive study of psychiatric consultations in a community primary care center. Primary Care Companion to the *Journal of Clinical Psychiatry, 3,* 190–194. doi.org/10.4088/ PCC.v03n0501

Podulka, J., Barrett, M., Jiang, J. & Steiner, C. (2012, February). Healthcare Cost and Utilization Project. *30-day readmissions following hospitalizations for chronic vs. acute conditions, 2008.* Washington, D.C.: Agency for Healthcare Research and Quality.

Pratt, L.A. & Brody, D.J. (2014, December). *Depression in the U.S. household population, 2009–2012. NCHS data brief, no 172.* Hyattsville, MD: National Center for Health Statistics.

Prochaska, J.O. & DiClemente, C.C. (1983). Stages and processes of self-change of smoking: toward an integrative model of change. *Journal of Consulting Clinical Psychology,* 390-393.

Prochaska, J.O. & Velicer, W.F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion, 12(1),* 38-48.

Pu, C., Bai, Y., & Chou, Y. (2013). The impact of self-rated health on medical care utilization for older people with depressive symptoms. *International Journal Of Geriatric Psychiatry, 28*(5), 479-486. doi:10.1002/gps.3849

Radovanovic, D., Seifert, B., Urban, P., Eberli, F.R., Rickli, H., Berteli, O., …Erne, P. (2014). Validity of Charlson Comorbidity Index in patients hospitalized with acute coronary

syndrome. Insights from the nationwide AMIS Plus registry 2002-2012. *Heart, 100,* 288-294. doi: 10.1136/heartjnl-2013-304588.

Rao, M. & Pilot, E. (2013). The missing link – the role of primary care in global health. *Global Health Action, 7*. Retrieved from http://dx.doi.org/10.3402/gha.v7.23693

Reiss-Brennan, B., Briot, P.C., Savitz, L.A., Cannon, W., Staheli, R. (2009). Cost and quality impact of Intermountain's mental health integration program. *Journal of Health Care Management, 55(2*), 97–113.

Regier, D., Goldberg, I., Taube, C. (1978). The de facto U.S. mental health services system: a public health perspective. *Archives of General Psychiatry, 35(6),* 685–693.

Robinson, P. & Reiter, J. (2007). *Behavioral consultation and primary care: A guide to integrating services.* New York: Springer.

Roberts, R.E., Deleger, S., Strawbridge, W.J., Kaplan, G.A. (2003). Prospective association between obesity and depression: Evidence from the Alameda County study. *International Journal of Obesity, 27,* 514-521.

Rothbard, A., Chhatre, S., Zubritsky, C., Fortuna, K., Dettwyler, S., Henry, R. & Smith, M. (2012). Effectiveness of a high end users program for persons with psychiatric disorders. *Community Mental Health, 48,* 598-603. doi 10.1007/s10597-012-9479-0

Rui, P., Kang, K. & Albert, M. (2013). National Hospital Ambulatory Medical Care Survey: 2013 Emergency Department Summary Tables. Retrieved from

Runyan, C. (2013). *Mental health care issues in America: An encyclopedia*. Edited by M. Shally-Jensen. Santa Barbara, CA: ABC-CLIO, LLC.

Sadowski, L.S., Kee, R.A., VanderWeele, T.J. & Buchanan, D. (2009). Effect of a housing and case management program on emergency department visits and hospitalizations among

chronically ill homeless adults: a randomized trial. *Journal of the American Medical Association, 301(17),* 1771-1778. doi: 10.1001/jama.2009.561.

Sanchez, K. & Adomo, G. (2013). It's like being a well-loved child: Reflections from a collaborative care team. *Primary Care Companion for CNS Disorders, 15(6).* doi: 10.4088/PCC.13m01541

Scott, D. & Happell, B. (2011). The high prevalence of poor physical health and unhealthy lifestyle behaviors in individuals with severe mental illness. *Issues in Mental Health Nursing, 32,* 589-597.

Seekles, W., van Straten, A., Beekman, A., van Marwijk, H., & Cuijpers, P. (2011). Stepped care treatment for depression and anxiety in primary care. a randomized controlled trial. *Trials, 12,* 171. http://doi.org/10.1186/1745-6215-12-171

Shi, L. & Stevens, G.D. (2012). Vulnerable populations in the United States. Second edition. San Francisco, CA: Jossey-Bass.

Silberbogen, A.K., Busby, A.K. & Ulloa, E.W. (2014). Impact of psychological distress on prostate cancer screening in U.S. Military veterans. *American Journal 'f Men's Health, 8(5),* 399-408. http://dx.doi.org/10.1177/1557988313516357

Small, L. (2010). Determinants of physician utilization, emergency room use, and hospitalizations among populations with multiple health vulnerabilities, *Health, 15(5),* 491–516.

Smith, R.C., Laird-Fick, H., D'Mello, D., Dwamena, F.C., Romain, A., Olson, J.,…Frankel, R. (2014). Addressing mental health issues in primary care: An initial curriculum for medical residents. *Patient Education and Counseling, 94, 33-42*.

Snell, C., Fernandes, S., Bujoreanu, I.S. & Garcia, G. (2014). Depression, illness severity, and healthcare utilization in cystic fibrosis. Pediatric Pulmonology. doi: 10.1002/ppul.22990. [Epub ahead of print].

Sommers, A.S. Boukus, E.R., & Carrier, E. (2012, July). Dispelling myths about emergency department use: Majority of Medicaid visits are for urgent of more serious symptoms. *Research Brief, 23,* 1-10.

Sommers, B.D., Graves, J.A., Swartz, K. & Rosenbaum, S. (2014). Medicaid and marketplace eligibility changes will occur often in all states; policy options can ease impact. *Health Affairs, 33(4),* 700-707. doi 10.1377/hlthaff.2013.1023

Stein, J., Andersen, R. & Gelberg, L. (2007). Applying the Gelberg-Andersen behavioral model for vulnerable populations to health services utilization in homeless women. *Journal of Health Psychology, 12,* 791-804. doi: 10.1177/1359105307080612

Steiner C. & Friedman, B. (2013). Hospital utilization, costs, and mortality for adults with multiple chronic conditions, nationwide inpatient sample, 2009. *Preventing Chronic Disease, 10.*

Tabachnik, B. & Fidell, L. (2007). *Using Multivariate Statistics*. Fifth Ed Boston, MA: Pearson Education, Inc.

Takahashi, P.Y., Heien, H.C., Sangaralingham, L.R., Shah, N.D. & Naessens, J.M. (2016). Enhanced risk prediction model for emergency department use and hospitalization in patients in a primary care medical home. *American Journal of Managed Care, 22(7),* 475-483.

Tang, N., Stein, J., Hsia, R. Y., Maselli, J. H., & Gonzales, R. (2010). Trends and characteristics of US emergency department visits, 1997-2007. *Journal of the American Medical Association, 304*, 664-670.

Taylor, A. W., Price, K., Gill, T. K., Adams, R., Pilkington, R., Carrangis, & ... Wilson, D. (2010). Multim–rbidity - not just an older persons issue. Results from an Australian biomedical study. *BMC Public Health, 10,*718-727. doi:10.1186/1471-2458-10-718

Teh, C.F., Sorbero, M.J., Mihalyo, M.J., Kogan, J.N., Schuster, J., Reynolds, C.F. & Stein, B.D. (2010). Predictors of adequate depression treatment among Medicaid-enrolled adults. *Health Services Research, 45(1),* 302-314.

TennCare. Division of Health Care Finance & Administration. (n.d.). *TennCare Medicaid.* Retrieved from https://www.tn.gov/tenncare/article/tenncare-medicaid

Texas Health and Human Services. (n.d.). *Medicaid and CHIP*. Retrieved from https://hhs.texas.gov/services/health/medicaid-chip

The Organisation for Economic Co-operation and Development (OECD). (June 17, 2013). Health spending continues to stagnate, says OECD. *OECD Health Data 2013.* Retrieved from http://www.oecd.org/els/health-systems/health-spending-continues-to-stagnate-says-oecd.html

Thota, A., Sipe, T. & Byard, G. (2012). "Collaborative Care to Improve the Management of Depressive Disorders: A Community Guide, Systematic Review and Meta-analysis." *American Journal of Preventive Medicine, 42(5),* 525-538.

Tinetti, M.E., Fried, T., R. & Boyd, C.M. (2012). Designing health care for the most common chronic condition – multimorbidity. *JAMA, 307(23),* 2493-2494.

Thomas, M.R., Waxmonsky, J.A., Gabow, P.A., Flanders-McGininis, G., Socherman, R. & Rost, K. (2005). Prevalence of psychiatric disorders and costs of care among adult enrollees in a Medicaid HMO. *Psychiatric Services, 56(11),* 1394-1401.

Thorpe, K., Jain, S. & Joski, P. (2017). Prevalence and spending associated with patients who have a behavioral health disorder and other conditions. *Health Affairs, 36(1),* 124-132. doi: 10.1377/hlthaff.2016.0875

Torio, C.M., Elixhauser, A. & Andrews, R.M. (2013, March). *Trends in potentially preventable hospital admissions among adults and children, 2005-2010.* HCUP Statistical Brief #151. Agency for Healthcare Research and Quality: Rockville, MD. Retrieved from http://www.hcup-us.ahrq.gov/reports/statbriefs/sb151.pdf

Tricco, A.C., Antony J., Ivers , NM, Ashoor, H.M., Khan, P.A., Blondal, E., …Straus, S.E. (2014). Effectiveness of quality improvement strategies for coordination of care to reduce use of health care services: a systematic review and meta-analysis. *Canadian Medical Association Journal, 186(15),* E568-78. doi: 10.1503/cmaj.140289. Epub 2014 Sep 15.

Unützer, J., Katon ,W, Callahan, C.M. , Williams , J.W. Jr, Hunkeler, E., Harpole, L., . . .Langston, C. (2002). Collaborative care management of late-life depression in the primary care setting: a randomized controlled trial. *Journal of the American Medical Association, 288(22),* 2836-2845.

Unützer, J., Katon W.J., Fan, M., . . .Powers, D. (2008). Long-term cost effects of collaborative care for late-life depression, *The American Journal of Managed* Care, *4(2),* 95-100.

Unützer, J., Harbin, H., Schoenbaum, M., Druss, B. (2013, May). *The collaborative care model: An approach for integrating physical and mental health care in Medicaid health homes.* Washington, D.C.: Centers for Medicare & Medicaid Services.

U.S. Department of Health and Human Services (DHHS), Substance Abuse and Mental Health Services Administration (SAMHSA), Center for Behavioral Health Statistics and Quality (CBHSQ). (2013, December). *Results from the 2012 National Survey on Drug Use and Health: Mental Health Findings.* (SMA) 13-4805. Rockville, MD: DHHS.

U.S. Department of Health and Human Services (USDHHS) Office of Minority Health. (2005). *A patient-centered guide to implementing language access services in health care organizations* . Washington, DC: American Institutes for Research. Retrieved from http://minorityhealth.hhs.gov/Assets/pdf/Checked/HC-LSIG-ExecutiveSummary.pdf

U.S. Preventive Services Task Force [USPSTF]. (2016, November). *Final Recommendation Statement: Depression in Adults: Screening*. U.S. Preventive Services Task Force. November 2016. Retrieved from https://www.uspreventiveservicestaskforce.org/Page/Document/RecommendationStatementFinal/depression-in-adults-screening1

Verdier, J.M., Byrd, V. & Stone, C. *Enhanced primary care case management programs in Medicaid: Issues and options for states.* (Resource paper). Hamilton, NJ: Center for Health Care Strategies, Inc. Retrieved from http://www.chcs.org/media/EPCCM_Full_Report.pdf

Vittinghoff, E. & McCulloch, C.E. (2007). Relaxing the rule of ten events per variable in logistic and cox regression. *American Journal of Epidemiol*ogy, 165 (6), 710-718. doi: 10.1093/aje/kwk052

Ward, B.W., Schiller, J.S., Goodman, R.A. (2014). Multiple chronic conditions among US adults: a 2012 update. *Prev Chronic Dis, 11*:130389.doi: https://www.cdc.gov/pcd/issues/2014/13_0389.htm

Warshaw, G. (2006). Introduction: Advances and challenges in care of older people with chronic illness. *Generations, 30,* 5-10.

Waxmonsky, J.A., Thomas, M., Giese, A., Zyzanski, S., Dickinson, M., McGinnis, G.F. & Nutting, P. (2012). Evaluating depression care management in a community setting: Main outcomes for a Medicaid HMO population with multiple medical and psychiatric comorbidities *Depression Research and Treatment.* doi:10.1155/2012/769298

West, S.G., Thoemmes, F., Cham, H., Renneberg, B., Schulze, J., & Weiler, M. (2014). Propensity scores as a basis for equating groups: Basic principles and application in clinical treatment outcome research. *Journal of Consulting and Clinical Psychology, 82(5),* 906-919.

World Federation for Mental Health [WFMH]. (2012, October). *Depression: A global crisis.* Occoquan, VA: WFMH.

World Health Organization [WHO]. (2012, October). Depression. (Fact sheet no. 369). Retrieved from http://www.who.int/mediacentre/factsheets/fs369/en/

Zur, J., Musmeci, M. & Garfield, R. Kaiser Family Foundation. (2017, June 29). Issue Brief: Medicaid's role in financing behavioral health services for low-income individuals. Retrieved form http://www.kff.org/medicaid/issue-brief/medicaids-role-in-financing-behavioral-health-services-for-low-income-individuals/

VITA

Girlyn Arganza Cachaper, PhD
College of Health Sciences
2114 Health Sciences Bldg.
Norfolk, VA 23529

EDUCATION

Doctor of Philosophy in Health Services Research, Old Dominion University, Norfolk, VA (Dec. 2017)
- Global Health Graduate Certificate Program (August 2015)

Master of Arts in Community Psychology, Georgia State University, Atlanta, Georgia (Dec. 2000)
Bachelor of Arts in Psychology, University of Virginia, Charlottesville, Virginia (May 1993)

PUBLICATIONS

Weingart, G.S., Glueckert, L., **Cachaper, G.A**., Zimbro, K.S., Maduro, R.S., & Counselman, F. (2017). Injuries associated with hoverboard use: A case series of emergency department patients. *Western Journal of Emergency Medicine*, doi: 10.5811/westjem.2017.6.34264

Nguyen, L., **Arganza, G.,** & Huang, L. (2004). Psychiatric Diagnoses and Clinical Characteristics of Asian American Youth in Children's Services, *Journal of Child and Family Studies,13(4),* 483-495.

National Technical Assistance Center for Children's Mental Health. (2004) *A Family's Guide to the Child Welfare System*. Funded by the Administration for Children's and Families, Department of Health and Human Services.

Huang, L., Ying, Y., & **Arganza, G** (2003). Children of Color in Systems of Care: An Imperative for Cultural Competence. In J.T. Gibbs and L. N. Huang (eds.), *Children of Color: Psychological Interventions With Culturally Diverse Youth*. San Francisco: Jossey-Bass Inc.

Huang. L., **Arganza, G.F**., & Ida, D.J. (2000). *Promising Approaches in AAPI Youth Development and Violence Prevention.* Submitted to the Substance Abuse, Mental Health Services Administration, Division of Program Development of the Center for Mental Health Services, Special Populations Branch.

PROFESSIONAL EXPERIENCE

Senior Information Analytics Specialist Jan. 2016 - current
Clinical & Business Intelligence, Sentara Healthcare
Business Info Analyst July 2010 – June 2014
Amerigroup/Anthem
Manager, Crime Statistics and Analysis Unit June 2006 – Sep. 2009
U.S. Peace Corps
Management Analyst Aug. 2003 – June 2006
U.S. Peace Corps
Research and Policy Associate Aug. 2000 – Mar. 2003
Georgetown University, Center for Child & Human Development
Community Psychology Graduate Research/Teaching Assistant Sep. 1997 - Aug. 2000
Dept. of Psychology, Georgia State University
Research Specialist Sep. 1993 - Aug.1995
Department of Psychiatry, Medical College of Virginia, Richmond, VA